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CONTENTS.

PAGE
ADVERTISEMENTS 125
INDEX OF APPLICATIONS FOR PATENTS 125
THE WRITING TELEGRAPH 127
REVIEWS—
  A Workman Poet's Ballads and Songs ... 128
  Ball's Mechanics 128
  Prusol's Dreams of Solitude 128
INTERNATIONAL PATENT LAW 128
PARADOXICAL PHENOMENA IN ICE CAVES 129
SEPARATION OF QUININE AND STRYCHNINE ... 130
FOREIGN COMPETITION IN THE HOME MARKET. —INVENTIONS WANTED 130
SCHOOL OF PRACTICAL ENGINEERING 130
RECENT AMERICAN AND FOREIGN PATENTS...... 131

PAGE
NATIONAL COMPETITION IN WRITING AND DRAWING 130
WOOL-SORTER'S DISEASE.............................. 131
POETRY 131
PROCEEDINGS OF THE INSTITUTE................. 132
MONTHLY NOTICES 132
THE BRITISH ASSOCIATION—
  President's Address................................ 133
  Mathematics and Physics 134
  Chemical Science.................................... 135
  Geology.. 135
  Biology 135
  Department of Anthropology.................. 136
  Geography.. 136

PAGE
  Economic Science.................................... 136
  Mechanical Science.................................. 136
THE CHROMOGRAPH...................................... 138
DUTIES OF ANALYSTS 138
PROCEEDINGS OF SOCIETIES—
  Royal Society 138
  Meteorological Society 138
  Royal Society of Literature 139
  Quekett Microscopical Society 139
  Anthropological Institute 139
  Entomological Society 139
  Historical Society 139
  Institution of Civil Engineers 139
ADVERTISEMENTS.. 140

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Reaping, Mowing, Making Hay, Gathering in Produce.—J. Wild, 3103. W. Clark (com.), 3138. J. P. Lawrence (com.), 3256.

Refrigerating, &c.—W. R. Lake (com.), 3072. W. R. Lake (com.), 3238.

Registering, &c.—J. R. Arnoldi, 3157. G. F. Redfern (com.), 3239. C. Milton (com.), 3251. G. Forbes, 3261.

Retorts.—H. W. Barstow, 3005. J. van Castel, 3122.

Roads, &c.—J. Mitchell and W. J. Cocks, 3035. W. F. Hunt, 3102. G. Hawksley (com.). 3287. C. Thieffny, 3349.

Rugs, &c.—F. Wirth (com.), 3280.

Safes, &c.—F. Wirth (com.), 3257.

Screens.—A. Slater, 3067.

Sewing and Embroidering.—S. Pitt (com.), 3079. C. D. Abel, 3226. S. W. Wardwell, 3229.

Shears, &c.—J. Foot, 3015.

Ship and Boatbuilding.—J. Casey, 3044. E. H. Hopkins, 3164. C. W. King, 3249. J. L. Morice, 3353. C. Tellier, 3354.

Ships' Rigging and Sails.—R. A. Ray, 3083.

Show Cases, &c.—J. A. Gillotte, 3026.

Sifting, &c.—W. Bennett, 3133. A. F. Gussander, 3190. W. Haydock, 3318.

Signals, Alarms, Communicating Apparatus, Conveying Sounds.—J. P. Quinn, 3076. S. Lawritzen, W. C. Johnson, and G. E. Phillips, 3132. J. R. Arnoldi, 3159. S. Greenway (com.), 3285. E. P. Gadsby, 3288. J. Longshaw and T. Priestman, 3337.

Smoke (Preventing, Burning, and Condensing.—A Ball, 3016.

Spades, &c.—W. Young, 2999.

Spindles.—T. Coulthard, 2974.

Spinning and Preparing for Spinning.—J. Boyd, 2953. T. Coulthard, 2974. W. R. Lake (com.), 3006. E. Hubner, 3029. H. Mason, 3033. J. Clough, 3043. H. Ambler, 3130. F. and A. Craven, 3144. W. R. Lake (com.), 3165. A. M. Clark (com.), 3181. W. Sutcliffe and A. Greenwood, 3212. W. R. Lake (com.), 3221. G. Scott, 3248. S. M. Grover, 3250. J. Walsh and J. Farran, 3270. G. Knowles, 3277. G. F. Dawson and J. Smith, 3309. W. G. H. Peltzer (com.), 3319. T. C. Wilson, 3358.

Sponge, &c.—W. R. Lake (com.), 3080.

Stamps, &c.—W. R. Lake (com.), 2984.

Starch.—A. N. Bruce, G. Stenhouse, W. McCowan, and A. Haddan, 3230.

Stays.—W. E. Whale (com.), 3170.

Steam Boilers, &c.—W. L. Wise (com.), 3004. S. and T. James, 3009. T. Russell (com.), 3142. A. M. Clark (com.), 3210. C. Jones, 3293.

Steam Engines.—A. M. Clark (com.), 2955. C. S. de Bay, 3041. C. E. Crighton and J. S. Ayton, 3099. J. R. Jefferies, 3172. T. B. Lightfoot, 3199. J. Binks, 3206. A. M. Clark (com.), 3210. H. Simon (com.), 3244. E. L. Beckwith and S. W. King, 3247. A. J. Sandron and G. Treherne, 3278. C. Jones, 3293. S. Geoghegan, 3296. J. King, 3346.

Teaching, &c.—W. E. Gedge (com.), 3100. T. W. von Kornatzki, 3326.

Telegraphs; Telegraph Printing Apparatus.—A. M. Clark (com.), 2962. W. Moseley, 3001. J. H. Johnson (com.), 3023. S. Lauritzen, W. E. Johnson, and S. E. Phillips, 3132. W. R. Lake (com.), 3207.

Tents, &c.—H. Williams, 3356.

Testing Fluids, &c.—A. Bernstein, 2956.

Thermometers, &c.—A. Budenberg (com.), 3060.

Thrashing Machines.—W. Watson and H. Scarr, 3096.

Threads, &c.—W. F. Hunt, 3102. F. Fenton, 3135. G. Hawksley (com.), 3287. C. Thieffry, 3349.

Tilling and Cultivating, &c.—S. Corbett, 3184.

Tobacco, &c.—J. Betjemann, 3106.

Tramways and Tramway Carriages, Tramway Locomotives—H. H. de W. Gray, 2997. H. W. Barstow, 3005. J. Dixon, 3039. C. E. Crighton and J. S. Ayton, 3099. T. Green and F. Tattersall, 3120. G. Smith, 3165. W. Brierley, 2205. W. Bell, 3218. A. Barclay, 3263. W. E. Winby, 3267.

Traps for Animals.—H. E. Warren (com.), 3333. G. Thomas (com.), 3335.

Umbrellas, Parasols, &c.—H. Currey, 3307.

Upholstery.—E. T. Hughes (com.), 2971. W. Exall, 3008. W. R. Lake (com.), 3080. J. Lokie (com.), 3201. F. Wirth (com.), 3242.

Valves, Taps, Stop Cocks, Plugs; Regulating the Flow and Pressure of Fluids.—T. Oxley, 2980. A. M. Clark (com.), 2985. F. Parsons, 2996. J. Casey, 3044. W. White, 3057. A. Budenberg (com.), 3060. D. Thomas, 3110. F. T. Smith, 3126. J. R. Jefferies, 3172. T. B. Lightfoot, 3199. J. Binks, 3206. W. R. Lake (com.), 3224. H. Simon (com.), 3244. E. L. Beckwith and C. W. King, 3247. G. Bamford, 3308. J. King, 3346.

Velocipedes, Bicycles.—W. Hillman, 3027. C. Wickstead, 3032. T. W. Jones, 3006. S. D. T. Sparrow, 3117. S. W. Thomas, 3274. T. Mudd, 3275. D. Campbell, 3351. H. McKee, 3364.

Ventilation; Supplying and Purifying Air for Buildings, Mines, Ships, Carriages, &c.—J. Bell and J. J. Coleman, 2970. A. Ball, 3016. W. R. Lake (com.), 3072.

Washing, &c.—R. D. Bennett, 3056. G. W. von Nawrocki (com.), 3109. E. Kempe, 3216.

Wearing Apparel, &c.—C. Kesseler (com.) 3094.

Weaving, Braiding, Plaiting, Preparing for Weaving.—J. Bywater and O. Bedford, 3037. J. Astill, 3054. F. Fenton, 3135. W. Chetham, 3187. A. E. Walker, W. Haigh, and J. Brook, 3204. H. Lomax, 3268. D. Scott and J. Edelston, 3300. T. E. Wilson, 3357.

Weighing, &c.—T. J. Smith (com.), 3157. W. H. Baxter, 3202.

Wheels for Carriages, &c.—C. Wicksteed, 3032. J. Southwick, 3074. D. Campbell, 3351. W. Clarke (com.), 3366.

Wheels for Machinery.—A. Vogt, 3291.

Winding Threads, &c.—J. Boyd, 2953. W. Hoyle and J. Rotheray, 3354.

Window Blinds, &c.—J. Rettie, 3053. J. Woodhead and W. Binns, 3143.

Windows.—J. H. Osborne, 2986. J. Woodhead and W. Binns, 3143. A. M. Clark (com.), 3151. G. Hackford, 3197.

Yeast.—J. Siddeley and A. M. Dearn, 3104.

THE WRITING TELEGRAPH.

Cowper's writing telegraph has been placed on the London and South-western Railway, and has been working most successfully from Woking to Waterloo, a distance of $26\frac{1}{2}$ miles, writing off the messages in ink, one after the other, in a perfectly legible manner, whether regular line messages or messages made up in order to give the instrument more work to do. On some days more resistance coils of wire have been introduced into the two line wires, in order to represent greater distances, and thus $62\frac{1}{2}$ miles and $99\frac{1}{2}$ miles have been worked through in a most satisfactory manner, it only being necessary in such cases to add a few more cells of the battery, which in no case was as powerful as is very often used on the same line. The effect of the currents through the multitude of other line wires, in close proximity to the two in use for the writing telegraph, was closely observed, and the effect of induction was so exceedingly small as only to produce occasionally a slight roughness in a straight line, when the pencil of the operator was quite stationary, but such effect was hardly ever perceptible in the writing itself, and never to affect its legibility.

We understand improved instruments are now being constructed, and will shortly be at work. The fact of this instrument requiring no clerk to receive the message, translate, and write it down, seems to be much appreciated, as a half-dozen such instruments may be telegraphing their yards of messages into one office; without the least assistance from the clerk, who may from time to time cut off and send out the ready written messages; so that not only is the time of "calling" (as with ordinary instruments) saved, but the time of waiting till the clerk can attend at the other end of the line to receive the signals, which very often amounts to a much longer interval than is required for the whole message to be transmitted, especially in offices fitted with many instruments.

There is also a great advantage in having an absolute record of what has been sent by the writing telegraph at the transmitting station. Another very important feature is the facility with which all that it is necessary to learn to use the instrument may be found out in five minutes. Every operation is exceedingly simple, and there are practically no fine adjustments anywhere. Variation in the power of the battery is of no importance, as its effect may be overcome by simply pushing the levers, carrying the springs against which the needles pull a little further in or out, as may be necessary. The pen, which is a very small glass capillary siphon tube, is, though of glass, very strong—it may fall several feet on to a bare floor without breaking—and is very easily adjusted.

The writing telegraph presents facilities and advantages which, we believe, will make its adoption rapid and extensive.

A lock, adapted for securing both the upper and lower sash of the same window, has been patented by Mr. George F. Knight, of Carroll, O. In consists in the combination of a detachable key having a nib, and a pivoted spring-actuated angular lever, having a lug to engage with a window sash, and the apertured case inclosing the lever, so that when the key is turned in a certain position its nib will catch over the edge of the free end of the lever, and traction on the key will then tilt the lever, but when turned into another position will release the lever.

An improvement in that class of coffee-pots which are provided with an inner receptacle or strainer, has been patented by Mr. Thomas Keys, of Jacksonville, Ill. It consists in providing the inner receptacle or strainer of a coffee-pot with an inwardly-projecting flange or lip near its top.

Reviews.

A WORKMAN POET'S BALLADS AND SONGS.

"Ballads and Songs." By ALEXANDER ANDERSON, Surfaceman. London: Macmillan and Co.

THE heading above given scarcely satisfies our notions of a proper indication of the character of the author and the work now under notice, for we should rather refer to Mr. Morrison as *the* Workman Poet; because, although poets have heretofore been found amongst the sons of toil, yet the inspiring Muse did not lead them to apply their poetical powers to things of their everyday working life, as is the case with Mr. Anderson. Here it may not be out of place to state that Alexander Anderson is a Scottish "surfaceman," that is, what on English railways is called a platelayer, whose duties, though little appreciated, are of the most serious kind, and the work, though badly paid, very important. The publication by Messrs. Macmillan of a new volume of Mr. Anderson's poems brings the "surfaceman" of Kirkconnel for the first time before the British public at large, his earlier writings being published in Scotland, though the *Athenæum* noticed the poems of "Surfaceman" on November 22nd, 1873, and January 1st, 1876.

The striking feature of Alexander Anderson is his verses about the railway and the trains. Familiarity, so far from breeding contempt, has inspired awe and admiration. Enthusiastic over "the mighty engine, as he bounds along his track," the "Surfaceman," with charming personal reflection, writes:—

> "Yet I glory to think that I help to keep
> His footsteps a little in place,
> And he thunders his thanks as he rushes on
> In the lightning speed of his race.
> And I think he knows when he looks at me
> That, though shaped of clay as I stand,
> I could make him as weak as a three hours' child
> With a paltry twitch of my hand."

Other striking poems concerning railway life and work in the "Ballads and Songs" are "Blood on the Wheel," telling with singular pathos the story of an engine driver who "died of a broken heart" for having run over his sweetheart as she was handing him a letter; and another, entitled "Nottmann," the narrative of a driver whose engine went within an inch of his son, lying asleep on the rails. All these railway poems are really admirable.

BALL'S MECHANICS.

"Mechanics." By ROBERT STAWELL BALL, LL.D., F.R.S. London: Longmans, Green, and Co. 1879.

THIS little work forms one of the series of "London Science Class-books" now being issued by Messrs. Longman, and we can only repeat that it is fully up to the mark of its predecessors and will be found of much service for school purposes, for which the series is specially designed. To those engaged in teaching, we recommend this little work and the other volumes which we have had occasion to review, as we feel convinced they will be found of great assistance to teachers.

PRUSOL'S DREAMS OF SOLITUDE.

"Dreams of my Solitude on the Mysteries of the Heavens." By JOSHUA PRUSOL. London: Reeves and Turner, 196, Strand. 1879.

THIS work, although the author disclaims as its purpose teaching astronomy, yet sets forth his views on astronomy and the motion of heavenly bodies as studied by him during his solitude in the Australian bush.

As the space at our disposal is limited, we cannot do better than summarise the purposes of this work, which treat, among other subjects, on—the Causes of Motion; the Government of Comets and the important Parts assigned to these as Heralds of Life to the Worlds; and the Natural Operations which have created and are still creating the Universe. And the author further states that the book, as we have before stated, is not for the purpose of teaching astronomy, "but of expounding the true principles on which that science is based." Further, he lays claim to the homely style of the work, which we can bear out; but as to accepting all his views and deductions, that is another matter, which we leave to those who make a study of astronomy, who may find in this work something that will be of use in the prosecution of their studies.

INTERNATIONAL PATENT LAW.

THE following is the report of the Patent Committee of the Association for the Reform and Codification of the Law of Nations to the Conference held in London during the past month:—The committee appointed at the Bremen Conference, in 1876, on the subject of Patent Right, and which was instructed by the conference held at Antwerp in the following year, to prepare a *projet de loi* on that subject, now have to report that they have completed their labours in this direction. During the past two years they have been engaged in preparing a series of resolutions to form the basis of a law, and a draft of these resolutions was, in April last, printed and sent to all the members of the committee in Great Britain, on the Continent, and in the United States, for their perusal; with a request that they would make suggestions thereupon. Several members sent in valuable comments, and regard was had to these in drawing up the final resolutions now presented to the Conference. Soon after the last Conference of the association, several members of the committee, representing different countries, took part, as delegates of the association, in the Paris Congress of Industrial Property, upon which they sent in a report to the Council. The committee consider the Congress to have been, on the whole, very satisfactory in its results, and they are glad to be able to state that as one outcome of the Congress, negotiations are now on foot with the object of establishing an international convention for the mutual protection of patent right and other property of the same kind. The committee have had their attention called to the Patent Bill introduced by the British Government into the House of Commons during the present session, but which was subsequently withdrawn. They have prepared a memorial on the subject of this Bill, to be presented, when approved by the Council, to the Attorney-General for the information of the Government, if a similar Bill be introduced next year. The committee appreciate certain valuable features in this Bill, such as the extension of the term of patents to 21 years in all cases, the clauses relating to amendments, and the omission of the objectionable provisions contained in the Bill of 1877 with regard to examinations. They regret, however, that the Government have not yet seen their way to two urgently-needed improvements—a large reduction of the fees, and the appointment of paid Commissioners. They are convinced that any Bill which does not satisfactorily deal with these two points will leave untouched some of the most important defects in the present British Patent Law. The following gentlemen have become members of the committee during the past year: Admiral J. W. M'Donald, Mr. Edward Crafton, and Mr. Alfred Barlow. The last of these gentlemen, the committee regret to state, is since deceased. —Signed on behalf of the Committee, A. H. BROWN, Chairman; JOSEPH G. ALEXANDER, Hon. Sec.

RESOLUTIONS ON PATENT LAW AS PASSED BY THE SECTIONAL MEETING.—[Note—The word "Paris" denotes that the resolution to which it is appended is one of those adopted by the International Congress of Industrial Property, held at Paris, in 1878.]—The Committee, after having deliberated on the subject, recognise that it seems impossible at the present time to propose one common law upon Patents for Inventions, on account of the numerous points of contact which the subject presents with divergent civil, commercial, and criminal law in general. Nevertheless, it is advisable to select a certain number of general principles which may be accepted in the laws of all countries. Consequently the committee adopt and propose to the Congress of the Association the following resolutions:—General Principles: 1. The right of inventors over their productions is a right of property; the law does not create, it only regulates it. [Paris.] 2. A temporary privilege of sufficient duration to ensure the remuneration of their labours and outlay should be accorded to inventors, less in their own interest than in that of industry in general.—Laws and Treaties: 3. Patents for inventions should be the subject of a special and complete law in each country. [Paris.] 4. Foreigners ought, with respect to patents, to be treated exactly the same way as citizens. [Paris.] 5. Stipulations for the reciprocal protection of patent rights between different countries should be contained in special conventions, independent both of treaties of commerce and of conventions for the mutual recognition of literary and artistic copyright. [Paris.]—Patent Office: 6. A special department for patents, trade marks, and registered designs should be established in each country. A central depôt of patents, &c., should be attached to it for the use of the public. Independently of any other publication, the administration of patents, &c., should publish a periodical official journal. [Paris.] —Fees: 7. The fees levied on patents should not be larger than is necessary to cover the expenses of the Patent Office, and should be levied by periodical payments.—What is Patentable, and by Whom: 8. All inventions, whether of procedures or of products, should be patentable, except financial combinations or inventions contrary to public order or to morality. In particular, chemical, alimentary, and pharmaceutical preparations should be patentable. [Paris.] 9. In the absence of fraud, the first applicant should be deemed the inventor. 9a. No person, except he be engaged in the Patent Office, should, by reason of his employment, be debarred from obtaining patents for his own inventions.—Provisions as to International Exhibitions: 10. Provisional Protection should be granted to patentable inventions exhibited at international exhibitions, or such as are officially recognised. [Paris, modified.] 11. The term during which inventions are thus protected should not be deducted from the term of the patent. 12. Such provisional protection should extend to all the countries represented at the exhibitions. [Paris.] 13. The fact that an article is an exhibit at an international or officially recognised exhibitions should not interfere with the right of seizing it as an infringement. [Paris, modified.]—Provisional Protection: 14. Provisional protection, for twelve months, should be granted on the applicant for a patent filing a provisional specification containing an outline description of the nature of his invention, in which no details should be required.—Procedure on Application: 15. No description of the invention—except its name—should be published before the issue of the patent, except as mentioned in paragraph 19. 16. The deposit of provisional specifications should, if desired by the inventor, be allowed to be made at the authorised local office, and at the consulates of the various nations, and on such deposit as a consulate, and the payment of the patent fees, provisional protection should commence as if the deposit had taken place in the Patent Office of the country represented. [Paris, modified.] 17. Prior to the expiration of the term of provisional protection, if the applicant desires to complete his patent, he should be required to file a full specification. 18. Where a patent has been applied for in one country, subsequent publication of the invention should not, during a period of twelve months, prejudice the original applicant's right to patent in other countries.—Examination: 19. On the filing of the complete specification, or the expiry of the term of provisional protection, if no complete specification has been filed, the provisional specification should be published. After the filing of the complete specification, and previously to its publication, the Patent Office should examine it, having regard exclusively to the following points:—(*a*) Whether the specification is clear. (*b*) Whether the invention is contrary to public morals. (*c*) Whether the invention is wanting in novelty, regard being had solely to prior publications in the Patent Office of the country. 20. For the purposes of examination, an invention should not be deemed to be wanting in novelty, unless a prior publication be found which comes strictly within one or other of the following conditions:—(*a*) It should not be more than twenty-five years old, and be in the form of a full description, identical with the applicant's description. (*b*) If the prior description be more than twenty-five years old, it should be proved that the identical invention as claimed by the applicant has been openly used within twenty-one years last past. 21. Should some parts of the invention come within these objections the applicant should be allowed to amend his specification. 22. Subject to such amendment, the patent should be granted, except in cases of fraud, or when the invention is contrary to public morals. 23. Reports and opinions of examining authorities, as respects applications for patents, should not be open to the public.—Procedure on Grant of Patent: 24. The complete specification should be published immediately on the granting of the patent. 25. The provisional protection should continue till the final grant or refusal of the patent.—Amendment: 26. Should it appear, after a patent has been granted, that the claims are too excessive, or that the specification is otherwise open to objection, it should be competent to the patentee to disclaim or amend his specification.—Term: 27. All patents should be granted for a term of twenty-one years. There should be no prolongation. 28. A patent, whenever granted, should bear date from the deposit of the provisional specification.—Effect of Patent: 29. All patents should, throughout their whole term, insure to the inventors or their legal representatives or assignees the exclusive right to the patented invention, and not a mere right of receiving royalties from third persons. [Paris.] 30. No one should be permitted, without the leave of the patentee, to produce, use, or sell the article which forms the subject of the invention, the patented machinery, process, or combination, or the article produced by such patented machinery, process, or combination. 31. A patent should have no effect on vehicles or ships, or appliances to vehicles or ships, which come but temporarily within the boundaries of the country, and the owners of which do not carry on business within the country. 32. The patentee should not be prevented from introducing from abroad articles manufactured under his patent. 33. A patent should be held to confer an indefeasible title to the invention described in the complete specification, unless it be proved that there exists a prior patent covering an identical invention, or that the identical invention has been publicly used within twenty-one years prior to the date of the patent, or fully described in a publication bearing date or printed within twenty-five years prior to that date. 34. Where it is proved that the public interest requires that a patent should be worked, and that the holder of the patent is not attempting to meet the demand, and refuses licenses, the Legislature should step in to prevent the public injury by a special law in each case. 35. The principle of expropriation for public utility is applicable to patents, but this should only be by virtue of a special law in each case, containing proper provisions for compensation. [Paris, modified.] 36. Patents granted in different countries should be perfectly independent of each other in all respects. [Paris.]

⁂ It is only just and fair to Admiral Selwyn, who was a member of this committee, to say that he strenuously protested against paragraph 7, which calls for "periodical" payments of patent fees, and relegates the decision of the sum to be paid (as did the law of 1852) to the time when it can be found out what will suffice to cover the expenses of the Patent Office. If a similar course had been adopted with reference to letters, we certainly never should have had the blessing of a penny post. Admiral Selwyn maintained what we understand was at first voted by the committee, but rescinded by the influence of a certain patent agent, "That the fees should be levied by a single payment of not more than £10." It is certain that if the industries of Great Britain are to be kept in existence, the inventive genius here must be at least as well protected by law and as lightly taxed as anywhere else. If not, it is folly to expect any other result of free competition than that trade and wealth will be gradually transferred to the country of the wiser legislators.

PARADOXICAL PHENOMENA IN ICE CAVES.

J. Ritchie, Jun., contributes to the last number of that high-class journal, the *Kansas City Review*, an interesting paper on the above subject, in which he states:—

The explanation of the phenomena peculiar to ice caves has been a matter of interest to scientists for the past two centuries—an interest that may be considered as beginning with the publication of notices and theories in the "Memoires" of the Royal Academy of France, as early as 1698. The most complete and valuable work on the subject is that of the Rev. George Forrest Browne, entitled "Ice Caves of France and Switzerland," published by Longmans, and now out of print. The best informed of scientists, even, are not aware of the mass of matter that has been written and published on this subject, owing to its wide distribution through the proceedings of so many learned societies. The work of Mr. Browne is at once surprising, not only from the thoroughness with which he has studied his subject, but from the vast amount of labour undertaken by him, and the extent of his really valuable original investigation, carried on in a truly scientific manner, and including, as it does, the results of his personal exploration of a dozen of these caverns. Having personally, and without a knowledge of the previous work of Mr. Browne, gone over a considerable portion of the references so well consulted by him, the credit due to that gentleman strikes us the more forcibly; but as our investigations have been with regard to the applicability of Mr. Lowe's theory, our own results may from time to time serve to throw a little more light on the subject.

The question of the temperature of ice caves has ever been a bone of contention among observers, whole pages of the "Memoires" (1712) being used in the discussion of the results of another writer, by M. Billerez, whose own standard is itself vaguely rendered as *tres-grand froid;* and again, M. Boz, declares the caves to be warmer in summer than in winter. Lately M. Thury, of the Academy of Geneva, in an account of a visit to the *glacieres* of the Jura and Vergy Mountains ("Bib. Univ. Arch. Sci.", 1861, p. 149), states that it is perfectly just to say that ice does not form there in winter, but rather in the fall, and, above all, in the spring, when the snow begins to melt. Mr. Browne, on the other hand, is inclined to reject the question of a winter thaw, so far as concerns the ice caves that he has visited, although the latter point is strongly held by the peasants, but at the same time cannot disbelieve the evidence brought forward to support the idea of a winter thaw in the other caves, which he had not as yet visited. Without attempting to discuss the matter of a complete disbelief, of the statements of the country people when antagonistic to the opinion of an observing scientist, we will consider the thaw as out of the question in the caves visited by Mr. Browne, and, with the theory of Mr. Lowe, it makes but little difference whether this point is admitted or not, for it is only a side issue at most, but there still remain a number of caves where the winter's thaw may be considered as well as established.

In regard to theories, all scientists have not been as temperate as was M. Thury, who, in the same article as that above referred to, states the most important thing to be the collection of facts, Mr. Browne's work not having been published until some years later, and he hardly considered that they were collected to verify any theory whatsoever. The theory advanced by M. Billerez, Professor of the University of Besançon ("Memoires," 1712), was based on the supposed action of nitrous salts in the earth above the cave, which, disintegrated by the heat of summer, were readily dissolved by the downward streams of water and in some way formed a freezing mixture. M. Boz, Royal Engineer ("Memoires," 1726), melted ice to find the salts, and finding none he disapproved of this theory, substituting instead a line of gorges contracting as they approached the mouth of the cave, and blowing into the cold wind. M. Cosigny desired very much to connect with the phenomenon a *talus* a soft earth ("Memoires des Savans Etrangers"), which *talus* was considered by Mr. Browne to be the mud washed down a slope of snow by the rains. In 1789, M. Prevost considered the cave to be a natural ice house, owing to the non-conductibility of the material of which it was formed; and later, M. Cadet published an evaporating theory, in which the trees on the top of the hill, above the cave, played an important part; but, on the authority of Mr. Browne, the circumstance on which he based his theory were wanting. Professor Pictet "Bib. Univ.", 1st ser., xx.) gives an account of a tour in the Jura Mountains, which has been translated and published in the *Edinburgh Philosophical Journal*. He attempted to account for the phenomena by a system of cold currents, producing evaporation; but his theory was combated and disproved the same year by M. Le Duc.

In reference to the cave of Illetzkaya-Zastchika, Sir John Hirschel (1842) expressed his opinion that the evaporation theory was not a probable one, and substituted a wave theory, that seemed so unlikely that Sir Roderick Murchison, in his "Geology of Russia," makes mention of it, but expresses himself of the opinion that it is not in accordance with the observed nature of the case. This theory, as well as that suggested by Prof. Piazzi Smyth in the case of the ice cave in the peak of Teneriffe, was, briefly that the winter's wave of cold would be retarded in its progress by the non-conducting power of the hillock in which the cave is situated, and would reach the cave in summer, and *vice versa*. It is curious, how so great a scientist should refer to so complex a cause phenomena which can be explained in a so much simpler manner. In regard to the cavern of Teneriffe, it lies at an elevation of 11,000 feet, and is, in consequence, not far below the level of perpetual snow. The circumstances here are favourable to the formation of ice by the process described by Mr. Lowe, the whole quantity of water and snow falling on its top being carried away by internal conduits, the sides of the mountains being free from the scoring produced by streams of water. The elevation and the low average temperature would seem, however, to admit of almost any desired explanation, whether of external temperature, non-conduction, or the effects of the previous winter's cold and ice.

The subject of ice caves had by this time excited considerable interest in this country, and at various times from 1838 to 1851, theories were suggested by various American scientists. Notices and discussion are scattered through the various issues of the *American Journal of Science and Arts* (Silliman's), but no distinct theory appears to have been given until that of Prof. Loomis, read before the American Society for the Advancement of Science, in 1860, but not appearing in its report, is probably not in print. A discussion of it may be found in "Hitchcock's Geology of Vermont" (i., 204), and it appears to have been that cold air has a tendency to descend; rivers or streams flowing through caves have a tendency to raise the temperature of the air, and the absence of these streams allows it to remain cold; hence the ice. This theory, which appears to have been quoted from memory, was disapproved of by Prof. Hitchcock, who declared that in that case all caves containing moisture and no running water would be ice caves. Hitchcock suggested an evaporation theory, but his main subject is rather a particular well in Brandon, Vt., and a peculiar phenomenon, rather than the general one of ice caves, and the larger portion of his arguments are for this reason special in their application.

This subject it is announced is to be continued.

SEPARATION OF QUININE AND STRYCHNINE.

OUR worthy contemporary, the *Analyst*, translates from the *Pharmaceutish Weekblad* (Jaargang 15th, No. 46) the following interesting statements by B. W. Dwars on the above important subject:—

When small amounts of strychnine must be estimated in presence of much quinine, it is advisable according to the author, to remove first the bulk of the quinine, and this is most effectually done by means of ammonium oxalate, quinine oxalate being almost insoluble in excess of that re-agent. The author used the following process for the analysis of a sample of the well-known citrate of iron with quinine and strychnia, which, as his analysis shows, is not always what it ought to be.

Five grms. were dissolved in a little water, super-saturated with ammonia, and shaken with chloroform. After evaporating the chloroform, and drying the residue at 110° C., there remained 0·81 grm.±16·2 per cent alkaloids. These were now dissolved in 10 c.c. warm water, and a few drops sulph. acid, then neutralised by ammonia and mixed with ammonium oxalate in excess.

After standing for twenty-four hours the quinine oxalate was collected on a weighed filter, the mother liquor still adhering to it removed by gentle pressure, and finally once washed with water. After drying at 100° C. it weighed 0·704 grms., or 0·618 quinine.

The filtrate and wash water were shaken up with ammonia and chloroform, and the latter yielded on evaporation 0·1775 grms., consisting of amorphous alkaloid (which ought not to exist in the pure drug), strychnine, and traces only of crystallizable quinine. It was twice treated with 3 c.c. of pure ether, which dissolved the amorphous alkaloid, and left behind 0·021 grms. of pure strychnine. Only minute traces of strychnine were lost. The final result was as follows:—

	Per cent.		Per cent.
Cryst. quinine	12·26	=quin. cit...	17·66
Amorphous quinine	3·13	= ,, ,, ..	4·44
Strychnine .,	0·42		
			22·10
	15·91		
Loss	0·29		

So 22·10 per cent. quinine citrate instead of 24 per cent.; and 0·42 per cent. strychnine instead of 1 per cent.

FOREIGN COMPETITION IN THE HOME MARKET.—INVENTIONS WANTED.

THE *Economist* publishes a table from the newly-issued report of the Commissioners of Customs, which shows the value of the principal articles of foreign manufacture imported into this country in each of the last five years. Compared with those of 1874, these imports in 1878 show an increase in value of £7,795,000, or about 19 per cent., and, as prices have fallen greatly in the interval, the increase in quantities, which is the true test, must be much larger. The growth is chiefly in cotton goods, which have risen 66 per cent.; and in woollens, in which there is a rise of 34 per cent. As regards cotton goods, the increase is chiefly in the imports from Holland, which have advanced from £206,000 in 1874 to £731,000 in 1878, while in woollen goods it is mainly in the supplies from Holland and France that the growth is slow. From the former of these the imports rose from £429,000 in 1874 to £1,325,000 in 1878, the increase in the imports from June being from £2,990,000 in 1874 to £4,061,000 in 1878. In reviewing these figures the Commissioners conclude that there is nothing in them to excite serious apprehension. The value of imports of this class, it is pointed out, is very small when considered in relation to its power of displacing or competing with the like productions of this country. But, nevertheless, it is well, more especially when the simultaneous decline in the exports of this country is considered, that this expansion of foreign imports should be kept in view. It shows that foreign competition is a real and actively aggressive force, which it would be unwise to ignore, and which must be met by persevering efforts on our part to cheapen and improve production. We (Editor SCIENTIFIC REVIEW) feel it our duty to point the moral of this by adding to it: Could anything be more cogent as an argument for sound laws for promoting invention, or, in other words, amending our patent laws?

SCHOOL OF PRACTICAL ENGINEERING.

ON Saturday morning, the 9th August, Captain Douglas Galton distributed certificates to the successful students of the Crystal Palace School of Practical Engineering. This school (says the *Times*), which is somewhat singularly situated in the south tower of the Palace, was established nearly seven years ago for the purpose of giving practical instruction in the rudiments of the profession and in the manipulation of materials, so that, on entering an engineer's office, the pupil may be at once useful to his principal, from having mastered the elementary details. The alphabet of the profession—mechanical drawing, pattern making, and foundry work, fitting and smith's work—is taught by a practical course, and may be supplemented by instruction in the civil engineering division. There is also a colonial section, for the benefit of intending explorers and settlers in uncivilised places, and in which the students learn the construction of nearly all the appliances they may need, from an artesian well to a horse-shoe. The report of the examiners for the summer term having been read, Captain Galton, in the course of his address to the students, said that the question of English technical education was most important. Great improvements had been made by Continental nations lately in the manufacture of machinery, and had been due mainly to the care with which they fostered technical education. The question how far we should be able to hold our own in the struggle for industrial ascendancy largely depended on our success in the same educational work. The artizan necessarily looked to precision, but the mechanical and civil engineer was under the further necessity of applying the knowledge of physical science to the conveniences of daily life. The course laid down at the school showed the vastness of the field of knowledge open to the practical engineer. Professor Huxley had said that success in life depended on industry and a good stomach; but to those two conditions he would add, in the case of engineers, a third—viz., the habit of observation. In their profession no man was too small to be important. An engineer's education was always progressive, in consequence of our daily increasing knowledge of physical science; but whatever the extent to which it ought to be carried, it should always be exact. No one had done more to make practical engineering exact than Sir Joseph Whitworth. Errors and inaccuracies of construction which had formerly been regarded as trivial, had been shown by him to be matters of primary importance in machinery; and, indeed, in respect of careful and minute measurement, the productions of his works approached as nearly as possible to mathematical and theoretical correctness. Such were the elements of success in engineering; not fortune or undisciplined genius, but knowledge, industry, observation, and accuracy.

NATIONAL COMPETITION IN WRITING AND DRAWING.

AT the ninth annual distribution of prizes, 1879, in connection with the above, Mr. Vere Foster has addressed to us the following announcement:—

In order to encourage the attainment of excellence in writing and drawing, to elicit latent talent, to afford opportunities for distinction, and to open up avenues to remunerative employment, I instituted in the year 1870 a graduated system of prizes open to competition by pupils of either public or private schools throughout the United Kingdom. Two thousand eight hundred and sixty-four prizes have been already distributed, amounting to £1,313 2s. 6d., and the competition has extended to almost every large town in Great Britain and Ireland.

During the past year there have been 859 competitors in ordinary writing, 110 in plain and ornamental lettering, and 320 in drawing and painting. About 500 boys have competed and 750 girls, and there are about the same number of competitors from Great Britain as from Ireland. The total number of books received is 1,432; they come from about 400 schools, situated in 77 counties.

For the first time the highest prize for ordinary writing has been awarded to a boy, Michael A. Kelly, a pupil of Lehinch National School, County Tipperary. I am sorry to have to say that the character of the writing has been growing steadily worse for the last few years, owing, as I believe, to the counteracting influence of the system of payment by results, as at present administered, there being no higher reward for excellence than for a mere pass, and execrable writing being a sufficient qualification for such pass in Government schools.

In plain and ornamental lettering the number of competitors (110) is exactly the same as last year, and the average quality continues to improve, so that, after awarding the full number of prizes which I had advertised, I have found it necessary to acknowledge real merit by issuing a considerable number of certificates of honourable mention.

The competition in drawing and painting also continues to be most satisfactory, especially in outlines of animals, and in the painting of flowers and landscapes. The prize list has, therefore, been largely extended. (A prize list accompanies this address).

The awards for ordinary writing were made solely by myself, and those for lettering, drawing, and painting by a most competent committee. A similar competition is invited for next year.

RECENT AMERICAN AND FOREIGN PATENTS.

An improved brake for waggons and carriages, which is so constructed that the brake will be applied by the action of the horses in holding back, and with a force exactly proportioned to the forward pressure of the load, which will allow the brake to be locked in position when off, so that the waggon can be backed without applying the brake, has been patented by Messrs. Lycourgas L. Johnson and William E. Johnson, of Alanthus Grove, Mo.

Mr. Lorenzo D. Hurd, of Wellsville, N.Y., has patented an improved running gear for waggons, in which each wheel may rise in passing over an obstruction independent of the others, and without changing the level of the waggon body, and in such a way as to bring the waggon more perfectly under the control of the team.

A device for clipping horses and shearing sheep, to be operated by steam or compressed air, has been patented by Mr. Ernest W. Noyes, of Bay City, Mich. The several parts are arranged so that the speed of the clipping knife will be fully under the control of the hand holding the implement, and the exhaust steam or air will be carried away from the animal.

An improved millstone driver has been patented by Mr. William J. Blackwell, of Waynesborough, Va. It consists in forming the inner ends of both sections of the driver with an eye that encircles the spindle, and in connecting the lapped ends of such sections by lugs and recesses which cause the two sections to act in unison.

An improved apparatus for separating coal from slate, and for separating other substances of different specific gravities, has been patented by Mr. David Clark, of Hazleton, Pa. It consists in the combination of the perforated inclined chutes and adjustable sides with the perforated stationary bottom and the tank, and other devices which cannot be clearly described without an engraving.

An improvement in the class of door latches known as "thumb" or "drop" latches, has been patented by Mr. Joseph R. Payson, of Chicago, Ill. It consists in extending the inner end of the lever through an orifice in the latch piece, the lever having a fulcrum in the rose, with a preponderance of its weight upon the inner or latch side.

A simple, cheap, and efficient fastener for plough colters has been patented by Mr. P. A. Bagwell, of Oakland, Ky. This arrangement of brace and fastener reduces the leverage or strain, when working, upon the colter and beam at their point of contact, and it holds the colter so that it cannot become loose, as it ordinarily does when used in ploughing heavy sods or among roots.

An improved process of inlaying metallic ornaments in wood or stone has been patented by Mr. L. A. Amouroux, of West Mount Vernon, N. Y. It consists in working the alloy in a hot or melted state into engraved or indented portions of the surface to be ornamented, and afterwards polishing all together.

Mr. Lyman R. Dexter, of Lancaster, N.H., has patented an improvement in sleds, which consists in a novel clamp for securing the runner to the upright. This device is an improvement on the clamp for which the same inventor received a patent in 1869.

An evaporating pan having a corrugated bottom stamped from a single piece of sheet metal, the corrugations of which extend alternately from opposite sides, so as to form a tortuous passage for the liquid, has been patented by Mr. John L. Becker, of Cincinnati, Ohio.

An improvement in riding saddles has been patented by Mr. William H. Herring, of Spruce Hill, Texas. The pommel has a hollow neck, and is formed in one piece with the fork and web, and wooden filling pieces are provided, which complete the tree.

Mr. William H. Fix, of Moffat's Creek, Va., has patented an improvement in axes, the object of which is to adapt the broad axe for use by either a right or a left handed person. The axe-head is pivoted to the handle, so as to rotate in the plane of the axis of the handle.

An improved cover for the steps of waggons, carriages, and other vehicles, for preventing the slipping of the feet in wet, muddy, and snowy weather, has been patented by Mr. William Mellon, of Philadelphia, Pa.

A runner stone—provided with a ventilating channel cut diametrically across the face, and having its bottom bevelled upon opposite sides of the eye, away from the direction of the rotation of the stone—has been patented by Mr. George Helford, of New York city.

Henry Reese, of Baltimore, Md., has patented a railway cross-tie of wrought iron, to which the rails are fastened by means of a permanent lug and removable clamp at each end of each tie. Both lugs face toward the same end of the tie, and the alternate ties are reversed end for end, so that the permanent lugs alternate on opposite sides of the base flanges of the rails. The movable clamp is held to its place by a simple form of spring, which takes up all wear and keeps the fastening tight and rigid. Patents are pending for the same invention in several European couutries.

Mr. R. D. Norton, of New Sharon, N. J., has patented an improved pulverising disk harrow, in which some of the details of the details of the machine are perfected so that it is rendered more durable and effective.

WOOL-SORTERS' DISEASE.

The simplest and most effectual, as it would also be found, probably, to be the most practicable, measure for preventing this disease would be the exercise of greater care and cleanliness in the making up of the bales in foreign parts. Falling fleeces, or the fleeces of dead animals, ought to be rigidly excluded; at least, if they are packed, they ought to be previously washed with soap and water, or some disinfectant. All the rest of the wool, sound or otherwise, ought also to be subjected to the same process, in order that the scab, parasites, and other filth might be removed before decomposition has rendered them poisonous. It will be urged that as Peru is a very dry country it might be very difficult, if not impossible, to wash the wool in the interior; to this, however, it is sufficient to reply that ports like Mollendo and Callao, from which the wool is shipped, have a water supply brought down to them from the Andes; while Puno, where the wool is collected, lies on the shores of Lake Titicaca, from which abundant water supply could of course be got. We may hope for better results to the health of our home operatives who are compelled to work in these wools when the foreign collecting trade is taken by Europeans out of the hands of the Indians, or when the Peruvian Government obtains more control over its lawless subjects. The same remarks apply, when the necessary changes are made, to the cleaning and collecting of the Van Mohair and other wools of Asia Minor. At any rate, when the use of such simple remedies promises such beneficial results, no time ought to be lost in attempting to put them into execution. Perhaps, too, the day may yet come when our Government may order its consular agents to attend to some of these matters, not the least, it may then be thought, of "British interests."—*Great Industries of Great Britain.*

VESPERA.

Per Mare, per Terra.

Fast fades the sunlight o'er the sea,
Reflected in the bay,
Where rolls the ocean wild and free,
O'er sand and shingle gay.

The larks high o'er the clover sing,
And sweet the cuckoo calls;
While swallows twitter on the wing
From out the ivied walls.

The corn is budding in the ear,
And waves with golden glow;
While bright the ruddy fire-flies peer,
Where harvest poppies grow.

The lowing kine leave bower and brake,
And homeward hums the bee;
The wind the bushy brambles shake,
Where pipes the thrush with glee.

Round the white cliff steals up the mist,
And shades the sunlight's hue;
While, far beneath the rock, I list
The floating sea-gull's mew.

A silver shoal amid the sea
Reflects the milky way;
And sinks the horizon by the lee,
Now fades the twilight grey.

Grim shadows mid the forest move,
As darkling thro' the skies,
Some messengers of tempest rove,
Ere the long daylight dies.

The rising moon bursts through the cloud
That hides the golden west;
And leaves beneath a dappled shroud,
Which folds her latest rest.

Close now the flowers their tender eyes,
And fold their petals o'er:
To sleep, while soft the night wind sighs,
And wake with morn once more.

Forth from yon ivy-mantled tower
The owl awaits her prey,
And swoops the bat o'er hall and bower,
From mouldering ruins grey.

Now, while the pleiads brightly peer,
Strong from the solar light,
The voice of nature whispers near—
A soft sweet voice—"Good night!"

Henry George Hellon.

European Ferns.—After nearly two years spent in its preparation, a new work on ferns, written by Mr. James Britten, F.L.S., with fac-similie coloured plates painted from nature by Mr. D. Blair, F.L.S., will be published shortly in monthly parts by Messrs. Cassell, Peter, Galpin & Co., under the title of "European Ferns."

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President, SIR ANTONIO BRADY.

THE SESSION 1878—1879

Is Ended.

N.B.—The Balance Sheet, 1879, can now be inspected.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

The Institute being now out of Session, no meetings have been held.

The Executive Council business calls for no report.

Monthly Notices.

A Technical School at South Kensington, near the post-office in Exhibition-road, is, it is reported, to be erected by the City companies, permission having been granted by the Commissioners of 1851. The selection of such locality shows how utterly incapable the City magnates are to deal with such a question. The place can never be of use to any but West London men, and the bulk of the working classes are not West Londoners.

Recent Experiments in Electric Lighting have led to careful investigation of all parts of the apparatus employed, and of the effects developed in the process of illumination. Prof. F. Rosetti, of Padua, contributes to the discussion a paper "Sulla Temperatura della Luce Elettrica," particularly the temperature of the polar points of the carbons during the production of light. The Professor having within the past two years made researches on the temperature of flame, and on the mean temperature of the sun, has brought experience to his present task, and states among his results that the positive pole of the carbon, during the production of light, has alway a temperature notably superior to that of the negative pole, and that this temperature varies with the variations in the intensity of the current.

Dr. G. H. Bachoffner died at his house in Hammersmith on July 22nd, aged sixty-nine. He was upwards for thirty years a popular lecturer at the Polytechnic Institution and the Royal Colosseum, on natural philosophy, chemistry, and astronomy. The Royal Polytechnic, in fact, was originated by him, a meeting being held at his house at which he suggested the scheme.

Messrs. Crosby Lockwood and Co. have just ready for publication a new work by Mr. Michael Reynolds, author of "Locomotive Engine Driving," entitled "The Model Locomotive Engineer, Fireman, and Engine-boy, comprising an Historical Notice of the Pioneer Locomotive Engines and their Inventors, with a Project for the Establishment of Certificates of Qualification in the Running Services of Railways."

Gold in Australia.—Mr. Brough Smyth, formerly chief inspector of the gold fields of South Australia, who has examined the Wynaad gold field, and reported to the Government thereon, states there is not much left in the alluvial deposits, but that the quartz reefs of that district contain more gold than many of those which have been successfully worked in Australia.

The Iron and Steel Institute will hold the next meeting in Liverpool, on September 24th, 25th, and 26th, in St. George's Hall, the use of which has been granted by the Corporation.

Dr. Braumueller, an Austrian mining engineer, states that in the substerranean waters of the "Fortschritt" coal mine in the Dux district, Bohemia, regular tides have been observed for the last six months. The Berlin and the Vienna Academies of Science are devoting much attention to this phenomenon.—*Athenæum*.

Storm Illumination of a Pine Forest.—M. Raoul Pictet, in the *Archives des Sciences Physiques et Naturelles*, states that the pine forest round St. Cergues in the Jura was, during a storm, suddenly illuminated with a light resembling the phosphorescence of the sea. The effect was, he says, produced by the action of the electricity of the atmosphere on the electricity of the earth, all the trees of the forest, which were wet with the falling rain, being turned into conductors.

The second volume of King's "Treatise on the Science and Practice of the Manufacture of Coal Gas," edited by Mr. Newbigging, C.E., and Mr. Fewtrell, F.C.S., is announced for publication early in September. This brings the subject down to the end of "Distribution." Another volume will complete the work.

Photographic Rifle.—M. Marey having expressed a wish for the invention of a photographic rifle which could take instantaneous views of birds in their flight, Captain Eugene Vassel proposes a small dark rifle chamber of 2·27 inches interior diameter, surmounted by a proper level and sight. By means of Muybridge's, Janssen's, or other contrivances for taking instantaneous pictures, he thinks that small views might be easily taken which could be subsequently enlarged. He also proposes a photographic revolver for taking a series of successive attitudes at a single operation.—*La Nature*.

THE BRITISH ASSOCIATION.

In accordance with our usual custom we give the place of prominence to the inaugural address, delivered by Professor G. J. Allman, F.R.S., the president this year of the British Association for the Advancement of Science, which was to the following effect:—

More than forty years ago, said the Professor, the French naturalist Dujardin drew attention to the fact that the bodies of some of the lowest members of the animal kingdom consist of a structureless, semi-fluid, contractile substance, to which he gave the name of sarcode. A similar substance occurring in the cells of plants was afterwards studied by Hugo von Mohl, and named by him protoplasm. It remained for Max Schultze to demonstrate that the sarcode of animals and the protoplasm of plants were identical. The conclusions of Max Schultze have been in all respects confirmed by subsequent research; and it has further been rendered certain that this same protoplasm lies at the base of all the phenomena of life, whether in the animal or the vegetable kingdom. Thus has arisen the most important and significant generalisation in the whole domain of biological science. Protoplasm lies at the base of every vital phenomenon. It is, as Huxley has well expressed it, "the physical basis of life. Wherever there is life, from its lowest to its highest manifestations, there is protoplasm; wherever there is protoplasm, there too is life. Its chemical composition is very complex. It may, however, be stated that protoplasm is essentially a combination of albuminoid bodies, and that its principal elements are, therefore, oxygen, carbon, hydrogen, and nitrogen. In its typical state it presents the condition of a semi-fluid substance—a tenacious, glairy liquid, with a consistence somewhat like that of the white of an unboiled egg. But its movements are not those of a simply physical fluid—they are spontaneous movements resulting from its proper irritability, from its essential constitution as living matter. No one who contemplates this spontaneously moving matter can deny that it is alive. Liquid as it is, it is a living liquid; organless and structureless as it is, it manifests the essential phenomena of life. The president reviewed the researches of Haeckel and Huxley, which resulted in the conviction that the slime at the bottom of the Atlantic, and named bathybus (lowest life), was protoplasm. Haeckel found near Jena simple sarcodic creatures with no apparent organisation of a lower rank than the simple amœba, which has been examined by the microscopes for 200 years. The amœba was, however, all important to biologists, for it affords the simplest form of nucleated cell, which is the basis of all physiological structure. In the most complex animals, however, even in man himself, the component cells, notwithstanding their frequent modification, are far from losing their individuality. Under the microscope a drop of blood, freshly taken from the human subject, is seen to be composed of a multitude of red corpuscles, swimming in a nearly colourless liquid, and along with these, but in much smaller numbers, somewhat larger corpuscles. The red corpuscles are modified cells, while the colourless corpuscles are cells—little masses of protoplasm. They will be seen to change their shape; they will project and withdraw pseudopodia (feelers), and creep about like an amœba. But, more than this, like an amœba they will take in solid matter as nutriment. They may be fed with coloured food, which will then be seen to have accumulated in the interior of their soft transparent protoplasm; and in some cases the colourless blood corpuscles have actually been seen to devour their more diminutive companions, the red ones. The animal egg is a true cell, consisting essentially of a lump of protoplasm enclosing a nucleus. The president then showed that it results from the researches of Mr. Geddes, Mr. Francis Darwin, Nägeli, and other investigators that there is no essential difference between this physical basis of life in plants and animals. In composition, process of growth, and development no distinction is possible. He also recited some interesting experiments of Claude Bernard, testing the effect of chloroform and ether on plants and seeds. Bernard exposed to the vapour of ether a healthy and vigorous sensitive plant, by confining it under a bell-glass into which he introduced a sponge filled with ether. At the end of half an hour the plant was in a state of anæsthesia; all its leaflets remained fully extended, but they showed no tendency to shrink when touched. It was then withdrawn from he influence of the ether, when it gradually recovered its irritability, and finally responded, as before, to the touch. It is obvious that the irritability of the protoplasm was here arrested by the anæsthetic, so that the plant became unable to give a response to the action of an external stimulus. Seeds of cress, a plant whose germination is very rapid, were placed in conditions favourable to a speedy germination, and while thus placed were exposed to the vapour of ether. The germination, which would otherwise have shown itself by the next day, was arrested. For five or six days the seeds were kept under the influence of the ether, and showed during this time no disposition to germinate. They were not killed, however, they only slept, for on the substitution of common air for the etherised air with which they had been surrounded, germination at once set in and proceeded with activity. The same great physiologist has also investigated the action of anæsthetics on fermentation. It is well known that alcoholic fermentation is due to the presence of a minute fungus, the yeast fungus, the living protoplasm of whose cells has the property of separating solutions of sugar into alcohol, which remains in the liquid, and carbonic acid, which escapes into the air. Schutzenberger has shown that fresh yeast, placed in water, breathes like an aquatic animal, disengaging carbonic acid, and causing the oxygen contained in the water to disappear. That this phenomenon is a function of the living cell is proved by the fact that, if the yeast be first heated to 60° C., and then placed in the oxygenated water, the quantity of oxygen in the water remains unchanged—in other words, the yeast ceases to breathe. All this proves that the respiration of living beings is identical, whether manifested in the plant or in the animal. It is essentially a destructive phenomenon—as much so as the burning of a piece of charcoal in the open air, and, like it, is characterised by the disappearance of oxygen and the formation of carbonic acid. One of the most valuable results of the recent careful application of the experimental method of research to the life phenomena of plants is thus the complete demolition of the supposed antagonism between respiration in plants and animals. After some recapitulatory observations, Prof. Allman remarked: To suppose, however, that all protoplasm is identical where no difference cognisable by any means at our disposal can be detected would be an error. Of two particles of protoplasm, between which we may defy all the power of the microscope, all the resources of the laboratory, to detect a difference, one can develop only to a jelly-fish, the other only to a man, and one conclusion alone is here possible—that deep within them there must be a fundamental difference which thus determines their inevitable destiny, but of which we know nothing, and can assert nothing beyond the statement that it must depend on their hidden molecular constitution. In the molecular condition of protoplasm there is probably as much complexity as in the disposition of organs in the most highly differentiated organisms; and between two masses of protoplasm indistinguishable from one another there may be as much molecular difference as there is between the form and arrangement of organs in the most widely separated animals or plants. Herein lies the many-sidedness of protoplasm; herein lies its significance as the basis of all morphological expression, as the agent of all physiological work, while in all this there must be an adaptiveness to purpose as great as any claimed for the most complicated organism. From the facts which have been now brought to your notice there is but one legitimate conclusion—that life is a property of protoplasm. In this assertion there is nothing that need startle us. When a thought passes through the mind, it is associated, as we have now abundant reason for believing, with some change in the protoplasm of the cerebral cells. Are we, therefore, justified in regarding thought as a property of the protoplasm of these cells, in the sense in which we regard muscular contraction as a property of the protoplasm of muscle? or is it really a property residing in something far different, but which may yet need for its manifestation the activity of cerebral protoplasm? If we could see any analogy between thought and any one of the admitted phenomena of matter, we should be bound to accept the first of these conclusions as the simplest, and as affording a hypothesis most in accordance with the comprehensiveness of natural laws; but between thought and the physical phenomena of matter there is not only no analogy, but there is no conceivable analogy; and the obvious and continuous path which we have hitherto followed up in our reasonings from the phenomena of lifeless matter through those of living matter here come suddenly to an end. The chasm between unconscious life and thought is deep and impassable, and no transitional phenomena can be found by which as by a bridge we may span it over; for even from irritability, to which, on a superficial view, consciousness may seem related, it is as absolutely distinct as it is from any of the ordinary phenomena of matter. It has been argued that because physiological activity must be a property of every living cell, psychical activity must be equally so, and the language of the metaphysician has been carried into biology, and the "cell soul" spoken of as a conception inseparable from that of life. That psychical phenomena, however, characterised as they essentially are by consciousness, are not necessarily co-extensive with those of life there cannot be a doubt. How far back in the scale of life consciousness may exist we have as yet no means of determining, nor is it necessary for our argument that we should. Certain it is that many things, to all appearance the result of volition, are capable of being explained as absolutely unconscious acts; and when the swimming swarm-spore of an alga avoids collision, and by a reversal of the stroke of its cilia backs from an obstacle lying in its course, there is almost certainly in all this nothing but a purely unconscious act. It is but a case in which we find expressed the great law of the adaptation of living beings to the conditions which surround them. The irritability of the protoplasm of the ciliated spore responding to an external stimulus sets in motion a mechanism derived by inheritance from its ancestors, and whose parts are correlated to a common end—the preservation of the individual. But, even admitting that every living cell were a conscious and thinking being, are we, therefore, justified in asserting that its consciousness, like its irritability, is a property of the matter of which it is composed? The sole argument on which this view is made to rest is that from analogy. It is argued that because the life phenomena, which are invariably found in the cell, must be regarded as a property of the cell, the phenomena of consciousness by which they are accompanied must be also so regarded. The weak point in the argument is the absence of all analogy between the things compared, and as the conclusion rests solely on the argument from analogy, the two must fall to the ground together. In a lecture to which I once had the pleasure of listening—a lecture characterised no less by lucid exposition than by the fascinating form in which its facts were presented to the hearers—Professor Huxley argues that no difference, however great, between the phenomena of living matter and those of the lifeless elements of which this matter is composed should militate against our attributing to protoplasm the phenomena of life of properties essentially inherent in it; since we know that the result of a chemical combination of physical elements may exhibit physical properties totally different from those of the elements combined; the physical phenomena presented by water, for example, having no resemblance to those of its combining elements exygen and hydrogen. I believe that Professor Huxley intended to apply this argument only to the phenomena of life in the stricter sense of the word. As such it is conclusive. But if it be pushed further and extended to the phenomena of consciousness, it loses all its force. The analogy, perfectly valid in the former case, here fails. The properties of the chemical compound are like those of its components, still physical properties. They come within the wide category of the universally accepted properties of matter, while those of consciousness belong to a category absolutely distinct—one which presents not a trace of a connection with any of those which physicists have agreed in assigning to matter as its proper characteristics. The argument thus breaks down, for its force depends on analogy alone, and here all analogy vanishes. That consciousness is never manifested except in the presence of cerebral matter or of something like it there cannot be a question; but this is a very different thing from its being a property of such matter in the sense in which polarity is a property of the magnet or irritability of protoplasm. The generation of the rays which lie invisible beyond the violet in the spectrum of the sun cannot be regarded as a property of the medium which by changing their refrangibility can alone render them apparent. I know that there is a special charm in those broad generalizations which would refer many very different phenomena to a common source. But in this very charm there is undoubtedly a danger, and we must be all the more careful lest it should exert an influence in arresting the progress of truth, just as at an earlier period traditional beliefs exerted an authority from which the mind but slowly and with difficulty succeeded in emancipating itself. But have we, it may be asked, made in all this one step forward towards an explanation of the phenomena of consciousness or the discovery of its source? Assuredly not. The power of conceiving of a substance different from that of matter is still beyond the limits of human intelligence, and the physical or objective conditions which are the concomitants of thought are the only ones of which it is possible to know anything, and the only ones whose study is of value. We are not, however, on that account forced to the conclusion that there is nothing in the universe but matter and force. The simplest physical law is absolutely inconceivable by the highest of the brutes, and no one would be justified in assuming that man had already attained the limit of his powers. Whatever may be that mysterious bond which connects organisation with physical endowments, the one grand fact—a fact of inestimable importance—stands out clear and freed from all obscurity and doubt, that from the first dawn of intelligence there is with every advance in organisation a corresponding advance in mind. Mind as well as body is thus travelling onwards through higher and still higher phases; the great law of evolution is shaping the destiny of our race; and though we may now at most but indicate some weak points in the generalisation which would refer consciousness as well as life to a common material source, who can say that in the far off future there may not yet be evolved other and higher faculties from which light may stream in upon the darkness and reveal to man the great mystery of thought?

A vote of thanks was moved to the President by Mr. Mark Firth.

Professor Huxley, in seconding the motion, said the occasion was a very tempting one for remark, especially to one who, like himself, had occupied his time on the precise topics discussed by Professor Allman. The president had alluded to a certain thing to which he (Professor Huxley) had given the name of "Bathybius," and it was said, with perfect justice, he had brought Bathybius into notice. At any rate he had christened it, and he was in a certain sense its earliest friend. A number of admirable persons had taken the little thing in hand and made much of it. He had hoped, indeed, that his young friend Bathybius would turn out a credit to him, but he was sorry to say as times had gone on Bathybius had not verified the promise of his youth. (Laughter.) In the first place, he could not be found when he was wanted: and, in the second place, when he was found all sorts of things were said about him. However, his own mind was perfectly at ease about young Bathybius; for, whatever else could be said about men of science, it could not be said that they endeavoured to conceal one another's mistakes. (Laughter and cheers.) He had the utmost confidence, therefore, that if Bathybius happened to be a blunder, it would be carefully exposed by somebody. Up to the present time that had not been done. (Hear.)

The vote of thanks was agreed to with acclamation. The President acknowledged the compliment, and the assembly broke up.

AUG. 21ST.

SECTION A.—MATHEMATICS AND PHYSICS.

The meeting of this section was held at Firth College. The opening address was delivered by Mr. G. J. Stoney, the President of the Section and secretary to the Queen's University, Ireland. He commenced by saying that in order to understand the position of natural science we must remember that the universe itself was one great whole, which included mind no less than bodies. We found in the present passing condition of our knowledge one group of sciences which investigated the phenomena of consciousness, another a distinct group of biological sciences, and a third the group of physical sciences which were all parts of the one great investigation of nature, but which for the present existed almost disconnected as separate provinces of human inquiry. The study of physical science has been remitted by the Association to its first two sections, which included the whole range of mathematics along with the study of the conditions of rest and motion in that part of matter which was endowed with mass, and of the phenomena of sound, heat, light, and electricity, with the applications of those abstract studies in molecular physics and to astronomy, crystallography, and meteorology. Now, in grappling with the problems of nature, a choice was seldom allowed of the method of investigation which should be employed. No reach of intellect applied to the materials in existence before 1860 could have elicited the fact that iron existed upon the sun. That great discovery was made by Prof. Kirchhoff, who was equally versed in the experimental method, or the method of observation, on the one hand, and the deductive method, or the method of reasoning, on the other. Prof. Kirchhoff employed, in the instance to which he was referring, the experimental method. He applied to the scrutiny of the sun's spectrum four prisms of the most homogeneous glass that could be procured, figured with the greatest accuracy that the eminent artist Steinheil could attain. He expended far more pains on their adjustment for each successive part of the spectrum than any of his predecessors had done, and he was rewarded by a more perfect vision of the sun's glorious spectrum than had met the human eye before. In a collateral inquiry, suggested by an observation made by Foucault, he and Bunsen placed a metallic vapour emitting bright rays in front of a still brighter incandescent body, so that the light from the brighter background had to pass through the vapour, and they found that this vapour now caused dark lines in the spectrum occupying the positions which its own bright lines had before filled. Prof. Kirchhoff thereupon added an appliance to his spectroscope which enabled him to bring a metallic spectrum and the solar spectrum together into the field of view, alongside of one another. On accomplishing this he saw 60 of the brightest of the iron rays as continuations of 60 of the strongest of the dark lines in the sun's spectrum; and, by an elaborate scrutiny, he satisfied himself that the observations had been pushed to a sufficient degree of exactness to make sure that a deviation would have been detected in any one of these 60 cases if it had amounted to as much as one-fourth of the average interval between consecutive lines of the solar spectrum. It would be observed that Kirchhoff's great merit and the real difficulty of his work lay in the scientific foresight and the industry which were required to frame hypotheses that were worth testing, to guide the investigation by these hypotheses, to contrive, construct, and adjust adequate apparatus, and to make with it the elaborate observations and the exact observations and maps which were necessary. But when by these means the new facts had been brought to light, the inference from them that there was iron in the atmosphere of the sun was an easy one. That example would better convey than a definition what were the characteristic features of an experimental inquiry. In mechanics valuable progress could be made by the mere mathematician, the student of deductive science; and in chemistry similar progress could be made by the mere experimentalist. Of all the physical sciences, those were the most purely deductive and the most purely experimental. What he desired particularly to invite attention to was that the two great methods of investigation might best be acquired in these two sciences, and that for a really sound grasp of the remaining physical sciences, and especially with a view to further advance in physical sciences, a command of both methods of investigation was essential. Prof. Stoney, in conclusion, said he did not know whether any of his predecessors in the chair had experienced as much difficulty as he had in selecting the topic to which he should invite the attention of the meeting, but he had been influenced in the choice which he had made of a subject by the single consideration of what he hoped might prove useful and not inopportune at a time when one University, which he trusted would prove a great University, was rising in the north of England, and when another University which had carefully and succesfully fostered a high standard of education for 30 years, and which had thereby deserved and won the respect of educated men, had just been sacrificed to ecclesiasticism in the sister isle. In that University he had held the most central office for 22 years, and in the discharge of his duty had largely to influence its destiny in respect to almost every educational problem. Parliament in its wisdom had now seen fit to destroy that work, and he had not been without hope that from the experience which had been gained some effect which would last might yet arise, and that the Queen's University might, perhaps, at its death bequeath a useful legacy to the University of Victoria. The advancement of science in the north of England would largely depend for many years on the wisdom of the regulations for scientific training which were adopted at first by the new University; and he had therefore ventured, at this peculiar juncture, to submit to the judgment of his scientific brethren the principles which much thought and many trials extending over several years had led him to believe should guide them in selecting that part of a curriculum.

A vote of thanks was proposed to Prof. Stoney by the Rev. S. Earnshaw, who remarked that the experimentalist had always a great advantage over the mathematician, but that both worked to the best effect when they worked together.

The motion was seconded by Mr. Merrifield, and unanimously agreed to.

The reading of the reports of committees next occupied the attention of the section for some time, and a paper was afterwards read by Mr. Earnshaw on "Etherspheres as a *vera causa* of Natural Philosophy," in which he sought to show that, every atom of matter in the universe being surrounded by an ethersphere of its own, every material body had its ethersphere also, which not only surrounded the whole body, but penetrated the interstitial spaces, and that by means of etherspheres the phenomena of light might be satisfactorily accounted for on the supposition that the ethereal medium was the medium of heat as well as light.

Mr. Gordon, the assistant secretary of the association, read a paper on some new instruments recently constructed for the "continuance of researches in specific inductive capacity," and illustrated his observations by the exhibition of a miniature five-plate inductive balance.

Papers were also read by Dr. Janssen, Mr. T. Wrightson, Mr. S. Holmes, and Mr. W. Cave Thomas.

SECTION B.—CHEMICAL SCIENCE.

In this section Prof. Dewar delivered the opening address. The time was past, he said, at which a president could give a review of chemical science from year to year, for it had now extended so rapidly in multitudinous directions that one would require to be a many-sided chemist to be able to lay before the section a complete history of the progress of chemistry. He would, therefore, take a broad view of the progress of the science. In the course of his observations, Prof. Dewar referred to the improvements in the manufacture of steel, as to which Messrs. Thomas and Gilchrist seemed really to have solved one of the most important industrial problems of our time. The Bessemer process did not eliminate phosphorus from pig iron treated by it, and extremely small proportions of phosphorus rendered steel cold short, so that the process had hitherto been only applicable to the rarer and costlier kinds of pig iron produced from exceptionally pure ore. Even thus restricted, the Bessemer process had produced results of incalculable importance, and the imagination could scarcely grasp the extent of the further development it must receive, and the importance of the further benefits which must flow from it now Messrs. Thomas and Gilchrist had overcome a difficulty which had baffled all previous workers in the same field by substituting a basic lining for the ordinary silicious lining of the converter, and adding lime to the charge during the "blow," and so oxidizing nearly all the phosphorus. He also referred to the improved method of obtaining soda by the ammonia process, which was as yet only employed by one firm in this country.

In proposing a vote of thanks to the President for his interesting and instructive paper, Prof. Williamson said that, without desiring to undervalue the results obtained by Messrs. Thomas and Gilchrist, it was, he considered, only a finishing off of the results obtained by Mr. Lowthian Bell, M.P., who had for many years worked at that particular subject with a combination of energy and concentration of skill that had seldom been exceeded in any study of the kind. (Hear, hear.)

Prof. Odling seconded the motion, which was agreed to.

Mr. Weldon read a paper on "Some Relations between the numbers expressing the Atomic Weights of the Elements," which he argued must have some kind of geometrical signification.

SECTION C.—GEOLOGY.

The introductory address in this section, which met in the Friends' School-room, was delivered by its President, Prof. P. M. Duncan, Vice-President of the Geological Society, in which he pointed out that of all the geological formations the carboniferous was the most important to mankind at the present time. It gave the earliest clear and definite idea of a land surface on the earth, or, rather, of the existence of many lands. The duration of the Carboniferous age in the broadest sense might be attempted to be estimated by the world-wide dispersion of identical species over the same serial horizons; and its relation to the preceding and subsequent formations might be appreciated from the fact that the Carboniferous flora, lasting as it did from the bottom to the top of the formation, was foreshadowed in the Devonian, and that it founded the Mesozoic. Thus the Australian, Himalayan, British, North and South American marine strata of the Carboniferous age contained many identical species of brachiopoda—the variations from the English types being very slight.

A vote of thanks having been passed to the President at the close of his address, various papers were read, among others a paper by Mr. F. E. Lee "On Fossils found in a Bed of Devonian Rocks at Saltern Cave, in Torbay, and in a Quarry of the Old Red Sandstone near Caerleon, in Monmouthshire," by Mr. V. Ball "On the Coalfields and Coal Production of India," and by Mr. F. M. Burton "On the Keuper Beds between Retford and Gainsborough."

SECTION D.—BIOLOGY.

This section is divided into three departments—(1) Zoology and Botany, (2) Anthropology, and (3) Anatomy and Physiology The first two departments only met to-day. The opening address was delivered by the President of the Section, Professor St. George Mivart, in the School of Art. After some preliminary remarks, he said he would first refer to Buffon's speculations concerning animal variation. In this matter it had been affirmed that Buffon stands to the doctrine of animal variability in a position analogous to that in which Linnæus stands to the doctrine of fixity of species. Buffon, in his chapter on the animals of the Old and New World, remarks, "It is not impossible that the whole of the New World's animals are derived from the same source as those of the Old, whence they have descended. . . . Nature is in a state of perpetual flux." In his chapter on the degeneration of animals he sums up, saying, "After comparing all the animals, and arranging them each in their own group, we shall find that the 200 kinds described here may be reduced to a small number of original forms, whence it may be all the rest have issued." As to the modes and causes of the origin of new forms, he entertained four connected opinions:—(1) He attributed much modifying efficacy to migrations; (2) also to the direct action of external conditions; (3) he believed largely in the origin of new forms by degradation; and (4) he regarded each animal as the manifestation of an individuating force, lying, as it were, at the root of the changes manifested by it.

At the close of the discourse, Prof. Allman moved a vote of thanks to the President of the section for his address. He said that Prof. Mivart had given a just estimate of Buffon's character. Buffon was to his mind a man of greater genius than Linnæus, and he had shown a wonderful anticipation of the great questions which had since agitated biology, and which were now the subject of close study. It was strange to see how utterly opposed to one another these two great contemporaries were. Linnæus had a very low appreciation of Buffon, and he was very fond of expressing that opinion. He had an extraordinary knowledge of system. Prof. Mivart had entered into various other subjects upon which he would not touch because they required deeper study than could be given to them there. He had very judiciously and with great care brought forward certain phenomena connected with the psychology of the lower animals, and he had quite correctly maintained that there was not a mere difference in degree, but that there was an actual difference in kind between the psychological power of the lower orders of animals and man. Setting aside the faculty of speech, which placed a wide gulf between the animal and man, a most remarkable difference was the absolute want in the lower animals of design, of drawing or of modelling. No lower animal exhibited the slightest tendency to represent another object by imitative design. Many had great powers of imitating gesture and sound, but they could not imitate form; but when they looked to the early days of man they found evidence that there was the natural love for drawing. We have on the bones of the mammoth representations of the mammoth himself, and there were traces of this power at the very dawn of humanity.

Sir J. Lubbock seconded the motion.

The motion having been put and carried, The President acknowledged the compliment, and said he had no difficulty in admitting the facts stated by Sir J. Lubbock, but they did not touch his point.

Sir John Lubbock called the attention of the section to the occurrence in England of Leptodora hyaline, a very interesting crustacean found in the deep Swiss lakes, subsequently in those of Switzerland, Russia, and Italy, and now in the Olton Reservoir, near Birmingham, though not in any streams or shallow waters. Like many marine organisms it is as transparent as glass—a peculiarity which is of advantage to vegetable feeders, as rendering them less conspicuous to their foes, and to predaceous species by enabling them to steal unsuspected on their victims. The anterior antennæ are peculiarly developed in the males, but quite small in the female. It has been a question whether these organs are for hearing or smelling. The latter seems most probable; where one sex attracts the other by sound, both sexes have the ear well developed. Of course the sex attracted must have a good ear in order to distinguish the sound; but so also must the singing sex in order to regulate the sound. Hence in such cases we do not find any marked difference between the auditory organ in the male and female. But with smell the case is different. The scent is a specific characteristic, and is not regulated or modified by the will of the individual. Hence, when one sex attracts the other, it is not necessary that the attractive sex should have well-developed organs of smell. Hence Weismann concludes that in leptodora the anterior antennæ, being much more highly developed in the male than in the female, are organs of smell. After describing some other curious points in its anatomy, Sir John observed that, like other animals of the same group, leptodora lay two kinds of eggs—one sort, in summer, which hatch rapidly, and a second in autumn which are provided with a thick coat and remain undeveloped through the winter, hatching only when the warm weather returns. Now, it is a most curious and interesting fact that, as Muller observed, these two eggs produce young which are quite unlike one another. In our common Daphnia the young at first are quite unlike their parents, having only three pairs of appendages, and being in what is called the "Nauplius" stage. Such young crustaceæ were at first supposed to be distinct animals and were called Nauplius, but subsequent observations have shown that many, he might say most, crustaceæ, however dissimilar they may be when mature, for instance, the lobster, cyclops, &c., commence life as a small oval being with three pairs of appendages, whence some naturalists, following Franz Muller, are of opinion that all our crustacea are descended from an animal of this form. But leptodora during the summer, even in its earliest days, is said to resemble the mature form, differing only in size and some details. It is therefore very interesting that the young when developed from winter eggs should commence life in the nauplius form.

A brief discussion followed on this paper, after which the reports of the various committees of the section were presented and the section adjourned.

Department of Anthropology.

This department met after the address in the Biological Section. Mr. S. B. J. Skertchly read a paper on the evidences of the existence of Palæolithic man during the glacial period in East Anglia.

Section E.—Geography.

This section met in the High School for Girls, under the presidency of Mr. Clements R. Markham, who delivered the opening address.

At the close of the President's address, which was loudly applauded, Captain Verney moved a vote of thanks.

This was seconded by Canon Rawlinson, and cordially agreed to.

Section F.—Economic Science.

This section met in the Council Hall. In the unavoidable absence of the President, Mr. Shaw-Lefevre, M.P. (owing to the recent death of his father, Sir J. S. Lefevre), Mr. Mundella, M.P., took the chair.

Prof. Leone Levi read a paper "On the Scientific Societies in Relation to the Advancement of Science in the United Kingdom."

Prof. S. P. Thompson then read a paper "On Apprenticeship Schools in France."

Mr. Hyde Clarke read a paper "On Credit as an Asset of a State."

Section G.—Mechanical Science.

This section met at the Church Institute. The opening address was delivered by the President, Mr. J. Robinson, President of the Institute of Mechanical Engineers. The subject of the address was "The Development of the Use of Steel during the last Forty Years, considered in its Mechanical and Economic Aspects." He said:—"In the metropolis of the steel manufacture it would seem fitting that the mechanical section of this great scientific association should direct its attention to this wonderful metal, the uses of which are daily becoming more numerous and important. But it may be said, on the other hand, that as the use of this material is perpetually growing more common, so are discussions as to its manufacture, composition, and characteristics becoming almost wearisome from their frequency. Notwithstanding an appearance of truth in this objection to our occupying more time in referring to the subject, I would venture to entertain the hope that a treatment of the question in its mechanical and economic aspects may prove not uninteresting to this meeting. At the time when railway extension was becoming general, about 40 years ago, the use of steel in this country was confined mainly to tools for mechanical purposes, including files and other articles, springs for vehicles, weapons of various sorts, and implements for agricultural and domestic uses; and it is proposed to measure the scientific and mechanical energy brought to bear upon the manufacture and improvement of this metal by the increase in the number of purposes to which it is applied, and the diminished price at which it can be obtained, as compared with the price at the time of its introduction for constructive works. There are, however, several important exceptions to this method of appreciation to which reference will hereafter be made." He referred in detail to the reduction of prices of steel, and asked:—"To what do we owe this enormous reduction of price and consequent more frequent and more economic application? The answer must be that, following the initiation of Krupp, our English engineers and men of science set themselves to work to discover and apply new processes for the production and manufacture of this most wonderful metal; and I venture to say that, in the whole history of metallurgy, from the time of Tubal Cain downwards, there has been no such progress in invention and manufacture as has been realised by the aid of such men as Mushet, Krupp, Bessemer, Siemens, Whitworth, Martin, Vickers, Bell, Bauschinger, Styffe, and many others within the period comprised in this retrospect; and our national predilections will perhaps lead us to the opinion that our own country may fairly appropriate a large share of merit for the results achieved. Another of the uses of steel to which attention may be given is that of the production of cannon of large size. Efforts had been made by some of our enterprising workers in metal to produce large guns of solid wrought iron; but the processes of heating and hammering were attended with so much difficulty that the attempt was given up. Here again Krupp stepped in, and succeeded, 32 years ago, in manufacturing cannon of cast steel, which unhappily have become ordinary commodities with those nationalities who could afford such expensive weapons. Since that time Krupp has produced about 2,000 guns, the heaviest being, when finished, 72 tons (16 inches)." After enlarging on the different processes, he said that the use of steel will be still further extended and its price reduced mainly by means of the methodical researches of our scientific metallurgists.

Mr. B. Latham read a paper "On the Temperature of Town Water Supply," in which he pointed out that any increase in the temperature beyond 55 deg. rendered water very unwholesome.

Mr. J. Oldham asked whether Mr. Latham could tell the various temperatures in artesian wells from 1,400 feet to 1,800 feet.

Mr. Latham said that he had made a very large number of observations, and he found that the temperature of the overflowing wells at Wandsworth was about 52½ deg. The temperature of the water in wells varied very greatly. In some of the deepest wells the temperature was colder than in the shallow wells.

Mr. J. W. L. Glaisher said that, having long been connected with the Registrar-General's Office, he had frequently had to take the temperature of the Thames water. It had long been recognised as a fact that cholera or diarrhœa never showed itself to any great extent until the Thames water reached 62 degrees. (Hear, hear). It stood to reason that when the water pipes were of small diameter, and were near the surface, the water partook of the temperature of the surroundings. He was in favour of having a much larger diameter of supply pipes. Water at a depth of 50 feet or 60 feet differed very little from the climate, but at a depth of several hundred feet the temperature was higher.

Captain Galton said that the water pipes should as much as possible be kept below the ground. The statements which had been made were a strong argument in favour of the abolition of cisterns and in favour of a standing water supply. (Hear, hear).

M. C. Beageron read a paper on Léon Francq's fireless locomotive. The idea of such a locomotive was originated at the time of the horse plague in New Orleans in 1872. After the Franco-German War, M. Francq, who was connected with the Paris tramways, gave his attention to discovering a motive power for his tramways. The object he had in view was to obtain such heat from water as would supply the motive power he needed. The engine in question was the result of his investigations. It had a large cylindrical reservoir, surmounted by a steel dome, two cylinders acting with piston rods, and a crank carrying two driving wheels, which were connected with other two wheels. The reservoir holds more than 700 gallons of water, heated to such an extent as to produce a pressure of 224 lbs. to the square inch. It was claimed for the new engines that they were very economical in every respect. It was pointed out that the engine would be especially useful on the metropolitan lines, as it neither gave off smoke nor deleterious gases. In a few weeks an engine of this character would be used on the tramway at Leeds, and another at Liverpool Docks.

Mr. W. H. Barlow said there were elements in this engine worthy of the most careful consideration. If it were possible to get a fuelless engine, a very important object would be gained, especially on those lines on which there were a number of tunnels.

Captain D. Galton said that he had seen the engine in question at work in Paris, and it had most favourably impressed him. The engine was largely used in the French plantations in the West Indies. There could be no question that all our tramways would be worked by steam very soon. Parliament had interposed difficulties, for Parliament always introduced difficulties. However, they were being met, and when the use of steam was sanctioned on tramways such engines as the one just described would be largely used. (Hear, hear).

Mr. J. Topham said that there was an increased demand for the haulage of tramways by steam, and the great *desideratum* needed was cheapness. Such a power ought to be produced at a cost of about 6d. per hour.

Mr. A. M'Donnell thought that an engine such as the one described would be a great advantage on short lines of railway, both from an economical and an efficient point of view.

The Chairman hoped that in the engine before them they had a solution of the difficulty of cost, the great cost having already stood so much in the way of the adoption of the principle.

This evening (August 21st) a *soirée* was given by the Master Cutler in the hall, which was very handsomely prepared for the occasion. A large company assembled.

BIOLOGICAL SECTION.

Dr. Pye Smith, in his address to the Department of Anatomy and Physiology, pointed out the objects of the association and the means by which it encourages research without absolutely providing for the endowment of it. The most important aim of the association is to obtain a more general attention to the objects and methods of science, and the removal of any disadvantages of a public kind which impede its progress. It is for this reason that the association travels from one to another of the great centres of population and intellectual activity of the kingdom endeavouring to aid in these objects. Dr. Pye Smith offered some considerations upon the bearing of biology, anatomy, and physiology, upon national well being and public interests. Biology, he said, is the science of the structure, the functions, the distribution, and the succession in time of all living beings. If "the proper study of mankind be man" he has learnt late in the inquiry that he can only understand himself by recognising that he is but one of a vast chain of organic creation that intelligible human anatomy must be based upon comparative anatomy, that human physiology can only be approached as a branch of general physiology, and that even the humblest mould or seaweed may furnish help to explain the most important problems of human existence, The branch of physiology which is concerned with man, not as an individual, but as a family, the branch which we now call anthropology, is obviously related to practical politics. In another department, that of psychology, the physiology of the nervous system has already thrown more light upon the mysterious phenomena of consciousness than was gained by the acutest minds of all ages without the help of anatomical methods. All the improvements of modern agriculture and stock-breeding rest upon more or less perfectly understood scientific principles, and the more perfectly the results have been first worked out in the laboratory the more safe and the more lucrative will be their application in the field. Still more important is the relation of physiology to the national health. The commonplaces of hygiene, which are now, one may be thankful to say, taught, if not practised, in almost every schoolroom and factory in England, are the direct results of the abstruse researches of Boole and Priestley, of Lavoisier and Pasteur. Ages of experience would not teach mankind the value of fresh air or the innocence of clear water. Indeed, astonishment has been expressed by a German professor at the peculiar immunity with which English skins will bear the daily and unstinted application of soap and water. If the art of keeping a community in health is but the application of plain physiological laws, it is no less true that the art of restoring the health—curative as distinct from preventive medicine—rests upon the same basis. All that the art of medicine can do is to apply a knowledge of natural laws, of mechanics and of hydrostatics, of botany and zoology, of chemistry and electricity, of the behaviour of living cells and organs, when subjected to the influence of heat and of cold, of acid and alkalies, of alcohols and others, of narcotics and stimulants, so as to modify certain deviations from ordinary structure and function which are productive of pain, or discomfort, or death. It is, therefore, plain that rational medicine, or keeping right and setting right the human body, must rest upon a knowledge of its structure and action, just as a steam engine or a watch could be mended upon general principles, but only by one who is familiar with the construction and working, and who could detect the source of the irregularity. The history of science proves that unconnected, unsystematic, inaccurate observations are worth nothing. For untold ages men have had ample opportunities of studying the indications of the weather, and have felt the utmost desire to obtain a knowledge of what they portend. Yet it may fairly be said nothing has been done to the purpose. Combined and systematic observations have been made in this country and America. The fact is that popular notions do not rest upon experience or observations—they rest, with scarcely any exception, upon metaphysical theories. If physiology is of such great national importance, and the necessity of experimental research is of such vital importance to the common national wealth, to agriculture, and commerce, to health and well-being, ought not its well-ascertained results to be taught in our common schools, and its prosecution directly encouraged by the State? On the other hand, Dr. Pye Smith objected to the endowment of research in biology by Government funds, on the ground that he would sooner remain dependent upon Germany for knowledge than give up local energy and the unofficial zeal which has made England what she is. Here and there we have institutions already under Government control and patronage. Let them be maintained as effectively and liberally as possible. The British Museum and its library, the Royal Observatory at Greenwich, and the Royal Gardens at Kew—these are great national institutions of which we are justly proud. Some persons have joined in an outcry against physiology. The prejudice is due entirely to the most frequent cause of folly—ignorance. Many persons supposed to be educated are so destitute of the most ordinary conceptions of natural science that they do not understand the necessity for experiments. So little do they appreciate the difference between formal knowledge and real knowledge that a distinguished statesman once said that he would as soon have his leg set by a man who had gained what he called his knowledge from books as by one who had "walked the hospitals." Next, there is a vulgar dislike of whatever is not obviously and immediately useful. When knowledge for its own sake is in question, those of the baser sort are always ready to cry, with equal ignorance of literature and of science, "*Cui bono!*" In another class of persons less ignorant and less stupid than these two, opposition to physiological experiments appears to spring from what may fairly be stigmatised as sentiment—that is to say, excitable, rather than deep feeling uncontrolled by reason. People first gratify their fancy by calling cats and dogs our fellow creatures, which, in one sense, undoubtedly they are, and then by the familiar fallacy of an ambiguous middle term, argue that it is cruel to put our fellow creatures to pain, or, as some would add, to reduce them to slavery, or to use them in any way for our own rather than their good. Such persons compel their fellow creatures to drag them through the streets, they eat their fellow creatures when sufficiently vivisected to be palatable, and they find philosophical excuses for those who kill their fellow creatures for fun, but they are profoundly shocked when their fellow creatures are hurt or killed for the benefit of mankind.

At the close of Dr. Pye Smith's address, Prof. St. George Mivart proposed a vote of thanks to him, and in doing so took occasion to support the views which had been enunciated with regard to vivisection. As physiology was an exact science, it was necessary that it should be studied properly, and not empirically.

Dr. Allman, President of the Association, seconded the resolution, and complimented Dr. Pye Smith upon the acuteness and logical character of his admirable paper.

The vote was cordially agreed to, and briefly acknowledged by Dr. Pye Smith.

Although we are compelled to reserve the completion of our reports as to the proceedings at Sections, still we may at once afford our readers information as to the concluding business:—

A meeting of the General Committee was held in the Church Institute at 1 o'clock to receive the report of the Committee of Recommendations. Dr. Allman occupied the chair. The attendance was small.

Captain Galton read the report of the General Committee of Recommendations. The following grants were recommended :—Dr. Lodge, New Form of High Insulation Key, £10 ; Prof. Adams, Standard of White Light, £20 ; Prof. Everett, Underground Temperature, £10 ; Dr. Joule, Determination of the Mechanical Equivalent of Heat, £50 ; Sir W. Thomson, Elasticity of Wires, £50 ; Mr. Glaisher, Luminous Meteors, £30 ; Mr. G. H. Darwin, Lunar Disturbance of Gravity, £30 ; Prof. Sylvester, Fundamental Invariants, £50 ; Mr. J. Perry, Laws of Water Friction, £20 ; Mr. W. E. Ayrton, Specific

Inductive Capacity of Sprengel Vacuum, £20; Rev. Prof. Haughton, Completion of Tables of Sun-heat Co-efficients, £50; Prof. G. Forbes, Instrument for Detection of Fire-damp in Mines, £10; Mr. J. M. Thompson, Inductive Capacity of Crystals and Paraffines, £25; Prof. Dewar, Spectrum Analysis, £10; Dr. Wallace, Development of Light from Coal-gas, £10; Prof. P. M. Duncan, Report on Carboniferous Polyzoa, £10; Prof. A. L. Adam, Caves of the South of Ireland, £10; Prof. Seeley, Viviparous Nature of Ichthyosaurus, £10; Mr. John Evans, Kent's Cavern Exploration, £50; Mr. John Evans, Geological Record, £100; Prof. W. O. Williamson, Miocene Flora of the Basalt of the North of Ireland, £15; Prof. Hull, Underground Waters of Permian Formations, £5; Dr. Pye Smith, Elimination of Nitrogen by Bodily Exercise, £50; General Lane-Fox, Anthropological Notes, £20; Mr. Stainton, Record of Zoological Literature, £100; Dr. M. Foster, Table at Zoological Station at Naples, £75; Dr. A. Gamgee, Investigation of the Geology and Zoology of Mexico, £50; Sir J. Lubbock, Excavations at Port Stewart, £15; Dr. Farr, Anthropometry, £50; Mr. Bramwell, Patent Laws, £5. In addition, £5 was given for the Investigation of Water in the Red Sandstone; total, £965. The report stated that committees had been appointed, without grants, to conduct investigations in the different departments into which the Association was divided. It was further recommended that the Council be requested to take further action with regard to the correspondence with the Government in respect to the Natural History Collection which it is proposed to remove from the British Museum to South Kensington.

The report was adopted, and the committee adjourned.

The concluding meeting was held at half-past two o'clock in the Albert Hall. Dr. Allman presided. There was a fair attendance, notwithstanding that the rain came down incessantly throughout the day.

The following figures were laid before the meeting by Captain Galton as showing the attendance throughout:—Old life members, 184; new ditto, 16; old annual members, 239; new ditto, 74; associates, 529; ladies, 349; foreign members, 13; total, 1,404. At Dublin in 1878 the attendance was 2,578; at Plymouth in 1877, 1,217; and at Glasgow in 1876, 2,652. The amount received in 1879 was £1,425.

The President then rose and said it was his pleasing duty to propose a vote of thanks to his worship the Mayor of Sheffield, who had been so successfully engaged in the organisation of the meeting. Those who were aware of the ardent desire of the Mayor for the promotion of the success of the meeting, and had seen, as he had done, his unremitting labours in carrying out those excellent arrangements which had secured in so eminent a degree that object, could not fail to be deeply impressed with the amazing amount of work which the Mayor had gone through and the admirable results which he had achieved in so short a time. He must further pay a tribute to his genuine warmth of heart, as well as thank the people of Sheffield for that cordial reception of the Association which had never been surpassed in any place in which it had previously met. (Cheers.)

Professor Ramsay, President-elect, seconded the vote of thanks, remarking that from the Mayor down to the humblest inhabitant Sheffield had given the Association a most generous and open-hearted reception. (Hear, hear.)

The motion was carried with acclamation.

The Mayor responded, saying that Sheffield was proud that the meeting had been attended with success. He had one word to say by way of criticism about the proceedings of the past week, and that was he could not entertain the idea that his ancestors were monkeys. (Laughter.)

Votes of thanks were also passed to the Master Cutler and Cutlers' Company, to which the Master Cutler responded.

The meeting was thus formally brought to a close, and the members of the Association, with the exception of the few who remain behind to join in the excursions to-morrow to Chatsworth and Thoresby, have once more dispersed, to assemble again next year on the 25th of August at Swansea.

THE CHROMOGRAPH.

An appliance for copying writings, drawings, &c., has been recently introduced to public use under the above title. It consists of two tin trays, which are filled with a soft substance which in some respects resembles caoutchouc, though one would be disposed to term it a soapy substance. It suffices to write with a special ink letters, circulars, &c., and to apply the same to the surface of this substance, which receives an impression from which may be rapidly taken a large number of copies. The utilily of such an invention is evident to all, and it can be safely said that before long its usage will be general in all places of business, for when a number of copies are required it will be found exceedingly useful.

The writing is done in the ordinary way, on any paper, using the ink supplied with the apparatus. After being allowed to dry, it is placed face downwards on the composition in the trays. A negative of the original is then obtained with absolute precision, the hand having been lightly passed over it, and permitted to remain for a short time. A sheet of paper of any kind is then placed on the negative, and smoothed down lightly with the hand. In two or three seconds the impression is completed and comes out perfectly clear: the operation is then repeated in the same manner. To remove the impressions from the composition it is sufficient to wash the surface with a soft sponge in clear water immediately after having taken the last impression. From this description it will be seen that the chromograph is used without press, inking, or steeping, and with any description of paper. The process is equally applicable for copying music, drawings, and in fact everything that can be produced by the aid of pen on paper.

The London office of the patentees is 36, Farringdon-street, London, E.C.

Duties of Analysts.—At a recent meeting of the Holborn District Board of Works, Mr. Walker called the attention of the Board to the fact that during the past few months there had been no complaints whatever in regard to adulterations in the district. He suggested that, instead of paying their analyst by salary, the Board should give a fee per case. Mr. Mather said they had certainly had no "flaming sensational cases" recently, but at the same time their analyst had not been idle, as would be seen by the number of samples that had been investigated. He thought it a matter of congratulation that the inhabitants were apparently being supplied with good and wholesome goods. The subject then dropped. Mr. Walker seems to consider that prosecution of the trader rather than protection of the public is the aim of the Sale of Food and Drugs Act.—*Chemist and Druggist.*

Roberts's "Holy Land."—Having purchased the copyright of David Roberts's *Holy Land*, Messrs. Cassell, Petter, and Galpin are about to publish the work in monthly parts. Great care is being taken to secure an accurate reproduction of the plates, for which purpose the illustrations are being re-drawn from the original folio edition.—*Academy.*

Proceedings of Societies.

ROYAL SOCIETY.

May 15th.—W. Spottiswoode, Esq., D.C.L. President, in the chair.—The following papers were read:—"Note on a Recent Communication by Messrs. Liveing and Dewar," by Mr. J. N. Lockyer; Sur la Limite Ultra-violette du Spectre Solaire," by M. A. Cornu; "On an Induction-Currents Balance, and Experimental Researches made therewith," by Prof. D. E. Hughes; "Some Researches with Prof. Hughes's new Instrument for the Measurement of Hearing: the Audiometer," by Dr. W. B. Richardson; "Note on the Invention of a Method for Making the Movements of the Pulse Audible by the Telephone: the Sphygmophone," by Dr. B. W. Richardson; and "On the Capillary Phenomena of Jets," by Lord Rayleigh.

METEOROLOGICAL SOCIETY.

June 18th.—Mr. C. Greaves, President, in the chair.—Lieut. A. Carpenter, Capt. D. Galton, Capt. M. Hall, Rev. W. P. Robinson, Messrs. H. Dodd, S. B. Goslin, A. Gray, and W. L. MacGregor were elected Fellows. The following papers were read:—"Report on the International Meteorological Congress held at Rome, April, 1879." by Mr. R. H. Scott. "Thermometer Exposure, Wall *versus* Stevenson's Screens," by Mr. W. Marriott. It being the practice of some observers to expose their thermometers on walls facing north, it seemed a suitable object of inquiry whether instruments so placed gave results comparable with those obtained from thermometers in a Stevenson stand in the open. A pair of Meteorological Office wall screens were fixed to the brick wall of an out-house with a northern aspect, so that the screens were in the shade except in the morning and afternoon of the summer months. The Stevenson screen was on a grass plot seventeen feet square, and about fifty feet north of the wall screen. The paper contains the results of the comparison of the maximum and minimum temperatures in the wall screen with those in the Stevenson stand for the twelve months ending 31st March, 1879. The figures show that the mean daily maximum temperature on the wall is below that in the open, the monthly difference varying from 0°·0 to −2°·1, that for the twelve months being —1°·0. The minimum temperature on the wall was mostly higher than in the Stevenson stand, the differences varying from —0°·1 to +1°·3, the mean for the year being +°·5. The individual difference, however, are sometimes much greater, the maximum temperature on the wall being considerably lower than that in the stand. For instance, the difference exceeded 4°·0 five times in September and four times in March, the greatest being 6°·7; these extremes occurred on fine calm days. The minimum temperature on the wall was more than 2°·0 higher than that in the Stevenson stand on five occasions in June, seven in July, and four in September. The mean daily range of temperature on the wall for the twelve months was 1°.4 less than in the stand in the open. The greatest difference was on March 9, when the range on the wall was 8°·5 less than in the stand. These results seem to show that although the mean temperature may be roughly ascertained from thermometers shaded by a wall with a northern aspect, this method of exposure affords less sensitive indications than those obtained from instruments in a properly exposed Stevenson stand. "On the Hurricane at Mauritius on March 20th-21st, 1879," by Mr. W. Ellis. "Meterology of Mozufferpore, Tirhoot, 1878," by Mr. C. N. Pearson. "Meteroligical Observations made on the Peak of Teneriffe," by Dr. W. Marcet. "On the Temperature of the Atlantic during December, 1877 and 1878," by Capt. H. Toynbee.

ROYAL SOCIETY OF LITERATURE.

June 25th.—Mr. Haynes in the chair.—Mr. C. H. E. Carmichael read a paper "On the Paris Literary Congress of 1878 and the International Literary Association," in which the author briefly analysed the principal questions discussed in the Congress convened last year by the agency of the Société des Gens de Lettres de France. Mr. Carmichael described in some detail the work of the first section of the Paris Congress, which was the one mainly concerned with literary copyright, and, after giving extracts from Victor Hugo's address at the public meeting in the Châtelet Theatre, passed on to the foundation of the International Literary Association at the general meeting of the Congress, 28th June, 1878. The constitution of the association was next discussed, and the objects at which it professed to aim were stated as set forth in the published bulletins, copies of which, as well as of the official *résumé* of the Paris Congress were laid on the table by Mr. Carmichael, who expressed his hope that the future work of the association would be carried on in the broad spirit of Victor Hugo's addresses.

QUEKETT MICROSCOPICAL SOCIETY.

June 27th.—Prof. T. H. Huxley, President, in the chair.—Four new members were elected. Nominations for officers and council to be elected at the ensuing annual meeting were made, and Messrs. Hainworth and Dobson were appointed auditors. Prof. Abbé, of Jena, gave an explanation of the theory of true aplanatic construction as applied to microscopical objectives. Mr. T. C. White detailed the results of some recent observations upon the mechanism of the tentacles of *Drosera rotudifolia*; and a discussion followed, in which Mr. Gilbert, Mr. White, and the President took part.

July 25th.—Anniversary meeting. Prof. Huxley, President, in the chair. The annual report of the committee congratulated the members upon the continued progress and prosperity of the society. The President delivered the annual address, in the course of which he pointed out the beneficial results to science which might reasonably be expected to follow the work of the members of such a society, even if only originally entered upon by way of amusement; and he indicated to them various lines of research which it lay in their power far more efficiently to follow out than was possible to men whose lives were devoted to science as a profession. The result of the ballot for officers and council was as follows:—President, Dr. T. Spencer Cobbold; Vice-Presidents, Prof. Huxley, Dr. Matthews, Mr. Michael, Mr. C. Stewart; to supply vacancies on the committee, Messrs. F. Coles, A. Cottam, E. Dadswell, J. W. Groves, J. W. Reed, J. C. Sigsworth, and T. C. White; treasurer, Mr. F. W. Gay; secretary, Mr. J. E. Ingpen; foreign secretary, Dr. M. C. Cooke.

ANTHROPOLOGICAL INSTITUTE.

June 24th.—Dr. J. Evans, V.P., in the chair. Mr. F. du Cane Godman and Mr. P. C. Wheeler were elected members. Prof. W. H. Flower read a paper "On the Osteology of the Natives of the Andaman Islands." There are few people whose characters offer a more interesting subject for investigation to the anthropologist than the native inhabitants of the Andaman Islands. Purity of type, due to freedom from mixture with other races for an extremely long period, owing to their isolated position and their inveterate hostility to all intruders on their shores, and exemplified in the uniformity of their physical characters, is to be found among them perhaps in a more complete degree than in any other group of mankind. The type, moreover, is an extremely peculiar one, presenting a combination of characters not found in any race of which we have at present materials for a satisfactory comparison. It is, indeed, probable that the more or less mixed and now scattered fragments of Negrito populations found in the interior of various islands of the Indo-Malayan Archipelago, and even upon some parts of the mainland of Asia, may have been derived from the same stock, but the special interest of the Adamanese consists in the fact that they alone of these diminutive, black, woolly-haired people occupy the whole of the small islands on which their ancestors have dwelt from time immemorial, or rather did so occupy them until the coming upon them of the English in 1857. The materials upon which the observations contained in the memoir are based are far more complete than any which have hitherto been brought together, consisting of nineteen skeletons and nearly thirty skulls. The skeletons indicate an average height of 4 ft. 9 in. in the males and 4ft. 6 in. in the females, thus showing that they belong to some of the smallest of known races. The skulls all belong to what is known as the brachycephalic, or round-headed type, having an average cephalic index (or proportion of breadth to length) of 82. The forehead is broad and flat, without any projection over the orbits. The nose is narrow, and the jaws less prominent than in the other black races. The proportionate length of the various bones of the limbs differs greatly from the European standard, but resembles those of the negro. With the Australians the Andamanese have very little affinity, the smooth hair of the former entirely separating them, independently of cranial characters, as dolichocephaly (or long-headedness), strongly pronounced brow-ridges, low orbital index, wide nasal aperture, great prognathism, &c. It is to the other woolly-haired races that we must naturally turn in endeavouring to find their nearest relatives. The Papuans and inhabitants of the Melanesian Islands differ from them greatly in their principal cranial characters, especially in the great height and narrowness of the skull. The Tasmanians had wider heads, but their facial characters were more like those of the Australians, and therefore widely different from the Andamanese. The African negroes, again, are almost all dolichocephalic, and, as a general rule, are extremely prognathous, and strongly platyrhine, or broad-nosed. Many of them, however, have the smooth brow and round orbit seen in the Andamanese, and not generally met with in the true Oceanic negroes. The natives of the Andaman Islands, with whom may probably be associated the less-known Aetas of the Philippines, and the Semangs of the Malay peninsula, thus constitute a race apart, to which the name Negrito may properly be applied. At first sight they appear in the craniological characters to present little affinity to either of the other woolly-haired races, but it is probable that they represent a small or infantile type of the same primary group, as nearly all the characters by which they differ from the other negroes—the smaller size, smoother and more globular heads, absence of supra-orbital prominences, rounder orbits, and less projecting jaws—are those which we find in the younger individuals of a species as compared with the older, or in the smaller species of a natural group as compared with the larger. It is very possible—but this is purely hypothetical—that the Andamanese, whose geographical position is almost midway between either extreme of the range of the woolly-haired races, may be the unchanged or little modified representatives of a primitive type, from which the African negroes on the one hand, and the Oceanic negroes on the other, have taken their origin, and hence everything connected with their history or structure becomes of the greatest interest to the anthropologist. The following papers were also read:—"On Palæolithic Implements from the Valley of the Brent," by Mr. W. G. Smith, and "Portstewart and other Flint Factories of the North of Ireland," by Mr. W. J. Knowles.

ENTOMOLOGICAL SOCIETY.

July 2nd.—Sir J. Lubbock, Bart., President, in the chair. Mr. V. R. Perkins was elected as an ordinary member. Mr. S. Stevens exhibited living specimens of *Tillus-unifasciatus* taken at Norwood. Mr. M'Lachlan contributed some further remarks respecting the sculptured pebbles from the Lake of Geneva, referred to at the last meeting. A number of the perfect insects forwarded by Prof. Forel proved to be *Tinodes lurida*, Curt., a common insect generally on the margins of lakes and rivers. Mr. W. L. Distant exhibited a specimen of *Papilio hystaspes*, Feld, taken at sea during a calm thirty miles from Singapore, and nine miles from the nearest land. Mr. W. Cole exhibited a remarkable variety of *Pyrameis cardui*, Linn., taken in Essex. The Secretary exhibited, on the part of Lord Walsingham, some specimens of a remarkable species of Tipulidæ (*Bittacomorpha clavipes*, Fab.) possessing greatly enlarged tarsal joints, captured at Pitt River, California. Sir S. Saunders communicated some additional explanations, received from M. J. Lichtenstein, respecting the rearing of the blister beetle *Cantharis versicatoria*.

HISTORICAL SOCIETY.

July 10th.—Mr. J. Heywood in the chair. The Rev. J. Billington and the Rev. G. W. Clements were admitted as members. The following papers were read:—"On the Elizabethan Persecutions," by Mr. J. Chapman; "On the Turanian Epoch of Hellenic Norse Mythology," by Mr. Hyde Clarke; and "Original Records regarding the Plague in Great Britain," by Dr. G. Harris. The Secretary reported that eighty-seven members had been admitted during the progress of the session.

INSTITUTION OF CIVIL ENGINEERS.

During the past session sixteen papers were read and discussed at the twenty-four ordinary meetings. For eight out of these sixteen original communications the council have awarded premiums. Mr. G. F. Deacon and Mr. J. N. Douglass receive Watt medals and Telford premiums, having previously had Telford medals for essays on "Street Carriage-way Pavements" and on the "Electric Light applied to Lighthouse Illumination." Mr. J. B. Mackenzie and Mr. A. F. Blandy have obtained Telford medals and premiums for their memoirs on "The Avonmouth Dock" and on "Dock Gates." Telford premiums have been bestowed on Mr. E. Dobson, Mr. J. Price, and Mr. J. E. Williams for their accounts of "The Geelong Water Supply, Victoria," "Movable Bridges," and "The Whitehaven Harbour and Dock Works." The Manby premium has been adjudged to Mr. J. P. Griffith in respect of his notice of the "Improvement of the Bar of Dublin Harbour." The second section of the minutes of proceedings contains a greater number of papers deemed more suitable for publication alone without being discussed at the meetings. The authors of four of these communications have been rewarded. Mr. G. W. Sutcliffe and Mr. E. Sang receive Watt medals and Telford premiums for treatises on "Machinery for the Production and Transmission of Motion," and on "The Best System of Wheel Teeth." Mr. W. G. Laws and Mr. G. Higgin obtain Telford premiums for a "Description of the Wylam Railway Bridge" and "Experiments on the Filtration of Water." There were eight supplemental meetings for the reading and discussion of as many papers by students, and in regard to these Miller prizes have been conferred on Messrs. A. C. Hurtzig, J. C. Mackay, P. W. Britton, and R. H. Redd, of whom the three first-named have before been similarly rewarded.

THE INVENTORS' INSTITUTE,

ESTABLISHED 1st MAY, 1862.

FORTNIGHTLY MEETINGS, DURING SESSION,

HELD (NOVEMBER TO MAY INCLUSIVE) AT

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, W.C.

PAST PRESIDENT—SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the Establishment of the INVENTORS' INSTITUTE till his decease, February, 1868.

PAST PRESIDENT—LORD RICHARD GROSVENOR, M.P., &c., from February, 1868, till May, 1871.

Council:

PRESIDENT OF THE INSTITUTE,

SIR ANTONIO BRADY.

The Right Hon. The Earl of Caithness, Vice-Pres.
*Sir Thomas Fairbairn, Bart., Vice-Pres.
*Beresford Hope, Esq., M.P., Vice-Pres.
*His Grace the Duke of Manchester, ice-Pres.
*Robert Richardson, Esq., C.E., Vice-Pres.
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